ENGINEERING NEWS

THE letter-ballot of the Master Car-Builders Association adopting the Janney type of automatic coupler as the standard of the Association, was practically as given in our last issue. The official count makes 474 votes in favor and 194 against, and it is therefore the adopted standard. None of the other standards submitted to letter-ballot received the necessary two-thirds vote and so were defeated. We rejoice to add that at this meeting of Oct. 13, the resignation of Mr. M. N. FORNEY, as Secretary of the Association, though presented was unanimously voted against by the Committee, and Mr. FORNEY will continue in the good work he has already done in this connection.

The following resolution was adopted at the last meeting of the Executive Committee;

Resolved, that a sub-committee of five be appointed to critically examine the different forms of couplers coming within the Master Car-Builders type, and report the result of their examination to the Executive Committee on the second Thursday in Jan. 1888, for their further action. Messrs. WALL, WADE, LENTZ, CLOUD and FORNEY were appointed such Committee.

PROGRESS on the Poughkeepsie bridge to date of Oct. 15, stands as follows:—All of the masonry of the bridge proper is completed saving on Pier 5 alone, and here the masonry is about on a level with high-water. Pier 5 is the one nearest to the east, or Poughkeepsie, shore. Commencing on the west side, the shore-arm of the first cantilever span is completed and anchored down, and first panel of the river-arm is connected and work is progressing on the next one out. On the west connecting span (shown in last issue) nearly one half of the metallic work is erected, and more would be done were it not for some awkward delay on the part of the railroad company in shipping material from Buffalo. On the east side the shore-arm of the last, or third, cantilever span is completed and anchored down. The erection of the connecting spans can be rapidly carried forward owing to the great spans and lengths of the members, as there are only eight panels in the 525 ft. span. The depth of truss is 75 ft. and the panel-length 65.6 ft., so the great length of the diagonal members, which are pinned at the centers, can be figured. The absence of verticals of any mass looks odd and gives to the structure a very airy but pleasing appearance. As might be imagined the single members are very massive, 20 tons being the weight of some of them as delivered. The riveting is done by a very complete hydraulic rig erected upon a traveling platform running along the false works and under the main erecting traveler. The riveter, with very long forward jaws, acts somewhat like a pair of scissors with a small ram between the rear jaws, or handle. The accumulator weight, of 6 tons, runs in guides and looks like the hammer of a pile-driver; the power acts with a blow and rivets 8 in. long, probably the longest ever used in this country, are set up with ease. Everything is working well saving some growl at the side-tracking of material by the railroads.

THE Manhattan bridge over the Harlem is progressing, with the centers for the east main arch nearly completed, and the massive skewbacks in place. Secretary NIVEN, of the Commission, says that the bridge is expected to be open to traffic within one year from the present date.

THE following law was passed by the Massachusetts Legislature last June: Section 1.—No passenger, mail or baggage car on any railroad in this commonwealth shall be heated by any method of heating or by any furnace or heater, unless such method, or the use of such furnace or heater, shall first have been approved in writing by the board of railroad commissioners; provided, however, that in no event shall a common stove be allowed in such car; and provided, also, that any railroad corporation may, with the permission of said board, make such experiments in heating their passenger cars as said board may deem proper.

Section 2.—Any railroad corporation violating any of the provisions of the preceding section shall forfeit a sum not exceeding $500.

Though the time allowed was short, the effect has been as follows, to date: The Boston & Albany is very nearly fully equipped with the Martin heater. The New York & New England has adopted the same. The Boston & Providence are putting in both the Sewall and the Gold systems, and other companies are trying the Baker and some other systems.

THE fact that the "Croton special" trains on the New York Central & Hudson R. R., are now heated by steam direct from the engine by the Martin system, is important as being the first practical step in this direction by one of our great trunk lines. And still more important is the announcement that other trains on e same road are to be speedily fitted with a similar device. President DEPEW seems to have changed his mind concerning the possibilities of heating trains from the engine.

THE Erie road is also making a test of the Martin system of car-heating on the train running from Buffalo to Lockport.

AN exchange says that in Russia the lighting of passenger trains by electricity is to be compulsory, at least upon the more important lines, and a special commission has been appointed by the "minister of ways of communication," to select the best system. Practical experiment on one of the railways will precede the selection. Good for Russia.

THE character of the silt through which the Hudson River tunnel is passing, is well shown by its behavior during the past few months. At the beginning of that period a rough bulkhead, designed to serve merely as a partial barrier, was built across the tunnel about 75 ft. from the heading. All air pressure was then removed and the pumps were stopped. Six weeks after an examination showed only about 2 ft. of water over the tracks at the bulkhead through which no silt had as yet found its way. This is remarkable, especially when we remember that all the water seeping through the 1,800 ft. of completed tunnel and through the shaft collected at this point. It proves that when the heading is subjected only to a pressure from without, the silt will move very slowly and will maintain its water-tight qualities as well in motion as when at rest. It would also seem to indicate, even under conditions the most unfavorable, regarding its continued compactness, that it is not liable to open at any point so as to form a passage for the water. This simple statement clearly illustrates why the silt constitutes such an admirable wall dividing the water from the air pressure, and why the face of the heading during work is left exposed. If not interferred with, it will be six or eight months before the tunnel and shaft are entirely filled with water. We understand there is a good prospect of work being soon resumed.

THE *Albany Journal* says that the lighting of the Hoosac tunnel by electricity has failed to fully meet the expectations of those in charge, and the experiment has been abandoned for the present.

THE accident this week on the Third Avenue Elevated Railway at 85th street, was somewhat peculiar, and was caused by too much zeal on the part of a switchman. There are three tracks at this point and a switch, and an engine was on the center track waiting to go out. As the passenger train of 5 cars swept by, the switch-tender in his hurry threw the switch just as the rear truck of the fourth car was approaching it, and this truck and the front one of the last car ran on to the center track. No particular damage was done, and the track was cleared within half an hour. Owing to the high guard timbers, this accident could only have occurred at such a switching point, and it does not follow that trains might make a practice of trying to jump the space between the two tracks, as some of the daily papers seemed to suppose in commenting on the first rumors of the present accident.

THE State Board of Tax Equalization of Illinois have made their report for the current year. There are 8,634 miles of main track assessed, belonging to 82 companies. The rate varies from $880 to $75,050 per mile, and the total amount is $66,517,478. The Tax Assessors of Tennessee have also made their report, which shows a total mileage of 2,227 miles, a maximum valuation of $26,576 per mile, and a total valuation of $32,361,855.

REPORT has it that the Pullman Palace Car Co. increased its capital stock from $15,920,000 to $30,000,000, at the annual meeting of Oct. 13. Prest. GEO. M. PULLMAN stated that this increase was to meet the cost of additional equipment and for further extension in the near future. Some say the latter clause covers the intended purchase of the Baltimore & Ohio palace car system.

THE total mileage of railways in the United Kingdom at the end of 1886 was 19,332, an increase for the year of 163 miles. The paid up capital amounts to $4,141,721,270, or $209,100 per mile.

ENGLISH journals claim that the completion of the Canadian Pacific Railway has been one of the chief causes of the recent activity in projecting Siberian railways, in hastening Russian construction towards Samarkhand and Tashkent, and in increasing the strength of the fortifications at Vladivostock against possible English attack with Vancouver as a base.

THERE will be quite an opening in New South Wales for dealers in wire fencing if the proposition is carried through of inducing the Government to buy material to fence in 12,000,000 acres against the rabbits that are now ravaging that country. Some 2,000 miles of fencing would be required.

THE following bridge accidents are reported: On Oct. 13 a 60 ft. span of a bridge over Cahokia creek, between Gillespie and Mt. Olive, Ill., gave way while being repaired by the Highway Commissioners. Thirteen men were hurt, some seriously.——On Oct. 16 the long bridge on the Wabash Railroad near North Morenci, Mich., was set on fire, but the danger was discovered by the engineer of an approaching train.——On Oct. 18 the temporary bridge across the Schuylkill at Market street, Philadelphia, Pa., was slightly damaged, narrowly escaping a wreck, by some freight cars on the Pennsylvania Railroad that were derailed by a collision.——On Oct. 17 a bridge on the Pittsburg, Fort Wayne & Chicago Railroad, near Louisville, O., was destroyed by fire; a train was flagged just in time.

THE most serious railroad accident of the week was a rear collision Oct. 13 on the Missouri Pacific Railroad, near Rock Creek station, Mo. An accommodation train from Independence for Kansas City was run into by the Wichita express, which was running at 45 miles per hour. A lady standing on the station platform was killed and several passengers were injured. The train dispatcher at Independence had forgotten to notify the express that the accommodation was ahead.

The open switch accident was repeated Oct. 17, this time at Petersburg, Dak., on the St. Paul, Minneapolis & Manitoba Railroad. The switch was left open, and being unprovided with switch lights, no warning was given. The engineer was killed. Perhaps sometime in the future, railroad companies will properly equip their switches, but at present these useful servants are getting in some very destructive work.

RAILROAD COMMISSIONER COFFIN, of the Iowa State Board, will offer a bill to the next Legislature requiring all railroads in that State to use automatic couplers on all trains. This movement is instigated by the late action of the Master Car-Builders' Association.

THE Pittsburg *Commercial Gazette* states that a freight train started out this week bound for Chicago, and with its 50 cars equipped with the Westinghouse triple-valve brake. This latter is a new device and the purpose of the present trip is to give it a thorough, practical test. The train will go to St. Louis and St. Paul and then back to Boston. Mr. WESTINGHOUSE himself goes with it, two passenger cars in the train accommodating himself and friends.

AT New Orleans, La., the heaviest rain of the year fell Oct. 18. The rear of the town was flooded and the draining canals filled; much damage was done to buildings and to the crops in the vicinity by the rain and wind. A washout of about 200 ft. occurred on the Louisville & Nashville Railroad near Lake Catherine.

THE headings of the tunnel on the Dresden branch of the Cleveland, Akron & Columbus Railroad met Oct. 13. The work was begun May 26, and the average progress per day was 11 ft., on the bench, 16 by 19 ft., 230 ft. per month. The material consists of limestone, shale, fire clay and coal; hand drills and augers were used in driving; timbering was used 6 ft. apart. The tunnel is 1,457 ft. long, 18 ft. 6 ins. by 15 ft. in the clear, single track, and will be lined with brick. The work is superintended by Mr. LARRY TOOLE; PAIGE, CAREY & CO. are the contractors. We are indebted to Mr. W. L. SISSON, Resident Engineer, for the above particulars.

Mr. LOVEGROVE, the Chief Surveyor of the Hackney Board of Works, has reported upon four kinds of granite pavement laid experimentally in 1883, each upon a length of 208 ft. He found that the Guernsey granite stood the traffic best and possessed most cohesion. In the case of concrete footways, he reports that those made wholly of Portland cement and slag "were seriously affected by the heat of the sun," and he recommends as a substitute for the slag alone, fine granite, slag and Kentish rag, or spar, for this purpose. Mr. LOVEGROVE suggests that all mastic or plastic paving be deeply lined into squares so that complete sections could be more easily removed, in case of repairs or trenching, and then repaired with a neat finish.

THE London *Daily News* says that the Russians have changed the route somewhat for their proposed Siberian Pacific railway, and now intend to commence building at Slatoust (on the line of the Ural Mts. and 125 miles south of Ekaterinburg). The entire length of the road would be 3,960 miles, and the estimated cost is $152,000,000, if we take the paper rouble as now being worth 40 cts., U. S. Currency; this includes the cost of the railway, five large bridges and ten smaller ones and a liberal allowance for contingencies. The projectors think the road could be built in five years, or at the utmost in eight, by commencing simultaneously on five sections. As projected the line would run from Slatoust to Omsk, to Krasnojarsk, Lake Baikal, or Irkutsk, then by the rivers Seeja and Amoor to Vladivostok on the Sea of Japan.

NEWS comes from Paris that M. DE LESSEPS is succeeding in an attempt to induce the French Government to take an interest in the Panama canal. In any event this rumor is being diligently spread abroad, but whether founded on fact, or simply used as a means of bolstering up the declining fortunes of the canal, is a question yet to be proven. A circular, said to be enclosed to bondholders, is not reassuring in its prayers and advice to the possessors of stock, etc. They are invited to put themselves on the defensive; not to take an interest in rival schemes and above all not to sell any of their securities to "those speculating for a fall." The latter item of advice is perhaps unnecessary just now. In the mean time advices from Panama, of Oct. 5, say that there is not much activity along the line of the canal. The company is reported to be turning all of its work over to the contractors; the sanitary conditions continue bad and the difficulty increases of finding laborers who can stand the climate. The last importation of labor is from Liberia, and on Sept. 19,700 stalwart negroes landed and were sent to join previous gangs of their countrymen now at Emperador and Bas Obispo; 1,500 more are expected during the present month. They are sturdy fellows, and if they succumb to the Chagres fever, no known race of men can stand it.

Lieut. JOHN P. FINDLAY, Assistant Chief Signal Officer, United States Army, has been in Troy, N. Y., superintending the completion and testing of a new helio-telegraph instrument of which he is the inventor. The machine is applicable to any code, and the arrangements are such as to preclude an error in the sending or receiving of a dispatch without gross negligence on the part of the operator. It consists of a double mirror by day, or two powerful lights by night, arranged at the ends of a bar. The flashes are made by keys and levers, a dot being sent by a single light, and a dash by two lights combined. The instrument combines the telescope level and signaling apparatus in one, instead of the separate instruments heretofore in use. Modifications of the instrument fit it for use in fortifications and in coast survey work.

Railway Trestles.*

(*Concluded from page 256.*)

In general it would seem that not much less than from 45,000 to 50,000 lbs. should be adopted as a center load for dimensioning track stringers in 16 ft. trestles where heavy engines are used.†

Computation of S. (See Fig. 5.)—*S* is the greatest value of the shearing stress at any section of the stringers. This can be computed in the manner already explained when treating of the stress on the trestle bents, but a slightly different load position must be used. The maximum shear comes directly over the edge of the

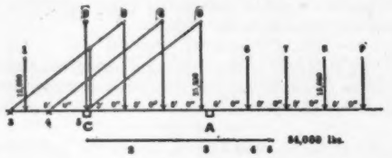


Fig. 5.

caps, and one of the heaviest loads should be placed at the edge of the cap with as many more of the heavier loads as can be brought upon the stringer, and the stresses are then obtained and summed up as in Fig. 3. For end crushing, the loads are advanced a little to the left till the heavy load is over end of stringer or center of cap, as shown in Fig. 5, the value of *S* being slightly greater for end crushing than for shearing stress.

Bank Bents.—Trestle work usually begins and ends in an embankment, and a common but not commendable foundation for the bank ends of the stringers is a series of four 6-ft. mud sills laid longitudinally on the embankments, upon which rests a 12 by 12 in. —8 ft. cap, which in turn supports the stringers, their ends abutting against a 3-in. plank set edgewise. An inexpensive and much more solid support, however, may be formed by driving under the stringers two 10 or 12 ft. piles and drift bolting a cap on top of them.

Bridge Ties.—The bridge ties are usually sawed 8 ins. broad and 7 ins., deep, and range from 9 to 14 ft. in length, the ends of long ties being supported by jack-stringers as already described. They are usually boxed down 1 in. on to the stringers to resist lateral stresses, and spaced from 10 to 16 or more inches from center to center, close spacing being intended to diminish the shocks caused by a derailed truck. They should be laid with great care and so as to afford a full bearing to the rail in order that each tie may receive and transmit to the structure its own proper share of the load and no more. Spiking ties to the stringer is neither necessary nor advisable.

Guard Rail.—The guard-rail is usually a 6 by 8 in. stick placed on each side at the outer extremity of the bridge ties. It serves to prevent the train from leaving the trestle in case of a derailment, but it also helps to stiffen and strengthen the structure and incidentally keeps the ties square with the rails and properly spaced, being boxed down onto the ties and then bolted to every third or fourth tie, some constructors using lag screws at intermediate ties. All trestles, however, should be provided with the ordinary iron guard-rail, and the addition of Mr. LATIMER'S re-railing device at each end together with the flaring of the wooden guard-rail into wings terminating in wooden posts is good practice. Three-inch planking, one foot broad, should extend along the trestle midway between the rails for convenience of trackmen and trainmen in crossing; and if the trestle is long, platforms should be built out on the caps at intervals of 200 ft. or more for the reception of tubs or barrels where water can collect for use in case of fire.

Material.—The material used in construction of trestles varies greatly. Yellow pine at the east and northern pine at the west seems to be the rule for stringers. Oak stringers are deemed treacherous and subject to internal decay, but are sometimes used with a high factor of safety on the score of economy, and oak and other timber is in constant use for caps and piles; guard-rails and bridge ties are either of oak or of chestnut, pine also answering well for all these purposes where cheaper than oak.

Cost of Trestles.—When estimates of cost are made for the trestles of an entire line, they are often averaged at $30.00 per M. ft. B. M. of timber, but above certain sizes timber increases so rapidly in price that in individual structures detailed plans and estimates are necessary.

Ordinary low pile trestles will cost not far from $4.00 per lineal foot, but may run somewhat cheaper or dearer, depending on the price of material, plan adopted, etc. As an example from actual practice, in the construction of the I., D. & S. Railway in Indiana, 1879 to 1881, pile trestle averaged $456 and superstructure of wooden bridges $362 per mile. Much of the Indiana section of this railway (68 miles) is located in hilly country, while the 84 miles west of the Wabash river may be classed as prairie road, being in the so-called "Grand Prairie" of Illinois.

Quantities.—The materials used per mile in trestles averaged about as follows:

On the Illinois section 4,890 ft. B. M of timber, 223 lin. ft. of piles, 316 lbs. of wrought-iron bolts and nuts, and 123 lbs. of cast-iron washers.

On the Indiana section 5,489 ft. B. M. of timber, comprising 2,333 ft. of oak at from $25 to $30 per M. erected, and 3,156 ft. of pine at from $13 to $16 per M.; 354 lin. ft. of piles at 25 cts. per ft. in position, 245 lbs. of wrought-iron bolts and nuts at 5½ cts. per lb., this all being on a contract covering 49 miles of road.

An average of three one-story sill trestles of moderate heights gives 78 ft. of timber, 3 lbs. of bolts and 2¼ lbs. of cast washers per lineal foot of trestle, and they required about 39 lbs. of bolts and nuts and 28 lbs. of washers per M. ft. of timber.

Again a couple of two-story sill trestles of entirely different design, 32 by 34 ft. high and 20 and 26 ft. span respectively, at $30 per M. for timber, cost about $6 per lin. ft. and contained 40 lbs. of bolts and 30 lbs. of cast washers per M. of timber.

In estimating iron work for trestles, we may take the cast washers at 1 lb. each, estimating bolt head and nut at .454 lb. for ¾-in. bolts and 1.923 lbs. for 1¼-in. bolts, and estimating each lineal inch of bolts at .124 lbs. for ¾-in. bolts and .344 lbs. for 1¼-in. bolts. For drift-bolts, etc. $W = .218\ d^2\ l$. W = weight in lbs. and d = diameter, and l = length in inches.

The price of material varies in different places. On our Indiana section timber is very scarce, and we pay for oak bridge timber from $13.50 to $30. per M. for pieces ranging from 20 to 50 ft. long, prices varying with the length.

Piling in ordinary lengths from 10 to 12 ins. diameter at smaller end, costs from 13½ to 15 cts. per lin. ft. All of these prices are for material loaded on the cars. Bolts cost about 3 cts. and cast washers 2 cts. per lb.

The labor on any particular style of trestle is usually estimated in dollars per M. of timber, and to estimate closely requires actual experience in construction.

BELL, in his work on carpentry, published in 1875, for ordinary bridges and trestles for railways, estimates labor in the Western states at about $11 or $12 per M. timber in the finished structure.

The labor on trestles will probably range from $7 $14 per M., depending upon nature of plan, rates of wages, locality where erected, etc. Piling we may ordinarily estimate at 25 cts. per lin. ft. for piles driven in position, and in default of actual data allow in ordinary cases for the length of the pile below the surface about 12 ft. in clayey soil of Indiana, and on the Illinois prairies about 18 ft. The above price, however, only applies to heavy contracts. On our own road, not allowing for interest on cost of plant, the cost of driving piles on heavy jobs varies from 5 to 8 cts. per ft. of piles, but for odd jobs the price will largely depend upon the amount of work to be done and the facilities at command.

†*Computation of W* (See Fig. 4.)—*W* being an assumed single center load which will produce at the center of the stringers a stress equal to the greatest which the given loads can produce, the nearer a load to the center of a stringer, the greater its destructive effect, hence

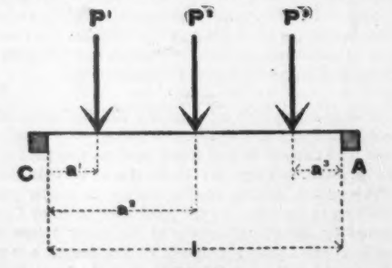


Fig. 4.

the maximum stress at the center will probably occur with the heaviest load is at the center of the span, and as many other loads on the stringers as possible. A few trials, however, will usually determine the position of the loads producing the maximum stress.

In general for any position of w^1, etc., on the stringer, p^1 = a center load producing a corresponding stress at center = $(\frac{1}{2})\ a^1\ w^1$.

And if W = a center load equivalent in its effect at the center of the stringer to the combined effect of $p^1\ p^2\ p^3$, etc.

Then $W = p^1\ p^2\ p^3$, etc., $= \frac{1}{2}\ (a^1\ w^1 + a^2\ w^2 + a^3\ w^3$, etc.)

That is if each load is multiplied into its distance from the nearest bent, and the products are added, doubled and divided by the clear span, the quotient is an equivalent load, which, acting at the center of the stringer, produces the same stresses at the center as the greatest which the given system of loads can produce; and if a stringer can safely sustain this stress, it will sustain any stress caused by any other position of the load system owing to its uniformity of cross section.

W as well as *S* may be computed by the methods of graphic statics or by any of the methods laid down in the works on bridge building.

* A paper read before the Illinois Society of Engineers and Surveyors, by EDWIN A. HILL, of Indianapolis, Ind.

Kind of Trestle to be Adopted.—Which class of trestle, pile or frame, is to be preferred in a given case, varies with circumstances. Pile trestle has a longitudinal stiffness, which a frame trestle has not, and which in the latter type can be obtained only by longitudinal bracing. Much depends on the character of the foundation and height of trestle. For all cases when with the appliances at hand the soil permits of driving piles to a secure foundation, and leaves length enough above ground for necessary height, I should favor pile trestle work. Where the nature of the ground precludes the use of piles, frame trestle must be used, and that foundation adopted which in each case gives the best result for the least money.

Mud-sills are poor practice, though much better than the reprehensible custom of laying the sill in a trench and covering it up with earth, which has been practiced in the past to an incredible extent. Where the longest pile that can be secured, or can be driven with the appliances at hand, must be driven nearly flush with the natural surface before sufficient sustaining power is obtained, the best plan is probably to cut off and start a frame trestle on the piles as a foundation, one stick usually serving both as cap to the piles and sill to the frame. But I am in favor, as far as possible, of using long piles so driven as to afford sufficient sustaining power and yet projecting above the natural surface to such a height as shall permit of sawing them off, capping them, and placing stringers directly on the caps, and of using a frame trestle only where this plan of construction can not be carried out: for in the case of frame trestles when the expense of frame and foundations is considered, I think we shall usually have a dearer structure than if piles are carried up to their extreme height before passing to the frame type of trestle.

Specifications.—In contracting for material, specifications must be prepared; and the following printed form in use on one of our leading western roads is handy and shows the usual requirements, the blanks being filled up and dimensions of pieces, etc., written in as occasion requires:

ORDER No—— BILL OF MATERIAL. BRIDGE No——

Specifcation for Timber.—All timber shall be first-class, of the best quality of —— and shall have been cut from living timber; it shall be free from rotton or loose knots, and without sap angles greater than — in., and shall be free from sun cracks and wind shakes, and must be evenly sawed.

Specifications for Iron.—All wrought-iron shall be of the best quality of fibrous iron, capable of resisting, without rupture, a strain of 50,000 lbs. per sq. in., and a strain of 25,000 lbs. per sq. in. without permanent set. All rods and bars shall be made without weld, and when designated shall have upset ends. The ends shall be cut with threads according to —— standard. All castings to be made from the best quality of iron for the work designated, and strictly in accordance with plans furnished.

I, ——, of —— County, State of ——, hereby agree to furnish ——, of —— County, State of ——, the bill of material as given below, and according to specifications accompanying, at the prices marked for each item. All material shall be subject to the inspection of ——, and all rejected material shall be at our loss. —— agreeing to replace all the material as specified below, on cars at ——, on the line of the —— Railroad, by the —— day of ——, 188-. We hereby agree to pay to said —— as damages, the sum of —— cents per —— per day, for each day, except Sundays, so delayed at the option of said ——.

No. of Pieces.	Name of Piece.	Size.	Leng'h	Ft. or lbs.	Price.	Total.	Re-m'ks

The Cincinnati Southern Ry. specifications required bridge timber to be "free from wind shakes, large knots, decayed wood, sap, or any defect that will impair its strength and durability. No sap angle will be allowed. * * * All framing must be done in a thorough and workmanlike manner."

Sap-wood finds but little favor with builders, as its life is only about one-fifth that of sound timber, and it should as far as practicable be ruled out in the specifications, though it will be found difficult to do this absolutely in practice.

Yates' standard specifications provide as follows: Bridge timber to be of white pine and white oak, sound, free from want, loose knots and other imperfections, and sawed straight and square, the several pieces to be accurately framed and put together with all necessary bolts and washers. They also provide that piles are to be "of round timber, straight, free from rot, large knots and other imperfections, barked, accurately pointed, and banded at the head while driven to prevent splitting, and when required, to be shod with a cast-iron shoe. To be measured after cutting off the tops, and paid for by the lineal foot, price to include cutting off, pointing and finishing smooth and square ready for caps."

Barking piles adds but little to the cost of work, but greatly increases their durability.

Preservation of Piles.—Piles are sometimes treated with some preservative solution before being used—creosote for example—and the time will come when this will be the rule rather than the exception. When properly treated the life is increased several fold, while with the proper facilities at hand the first cost of material is only increased about from 40 to 60 per cent. With piles costing 25 cts. per ft. driven, and lasting not more than 8 or 9 years, it would certainly seem economy to expend a few cents more per foot, since their life is thereby greatly prolonged.

Piles usually fail either by being destroyed by boring worms, which work under water and completely honeycomb the pile, or else they rot prematurely near the water line or ground line. After a thorough treatment by some chemical process, perhaps the next best and certainly a very judicious thing to do is that recommended in the Report of the Ohio Railway Commission for 1884, being an application of hot tar at the ground line where the pile first gives out. It is quite probable that a similar and liberal use of white-wash or quicklime would be a good investment, as very good results have in this way been obtained with railway cross ties.

Dimensions for Standard Trestles.—The following dimensions are submitted for a one-story pile trestle suitable for a western road of ordinary traffic.

Bents of 4 piles each. Piles not less than 8 in. diameter at smaller end, driven to a 2 in. penetration under a 2,000 lb. ram falling 20 ft. or an equivalent thereto; sawed square at top. To these a 14 by 14 in.—14 ft. cap is secured by 1¼ in. drift b lts driven 8 ins. into each pile. Two sway braces of 3 by 12 in. plank bolted to the cap and to each pile. Bents spaced 15 ft. from center to center. Track carried by 6 stringers, size 6 by 16 in. by 20 ft. spaced by iron spools or blocks. Each set of stringers secured to the cap by a 1¼ in. drift bolt or by wooden blocks. Stringer bolts ¾ in. diameter with cast washers 3 in. diameter. Bridge ties 7 by 8 in. by 9 ft. spaced 12 in. center to center and boxed down 1 in. on stringers. Guard-rail 7 by 8 in., boxed down 1 in. on ties and bolted to every third tie with lag screws at intermediate ties. Iron guard-rail on entire length of trestle, with Latimer re-railing device at each end with wooden guard rails flared and terminating in guard posts projecting about 4 ft. above ground.

Inspection and Records.—Bridges and trestles are usually numbered in consecutive order, and some permanent record kept of dimensions, repairs, etc. I would suggest the following system of records as being in some respects an improvement on present practice.

Number all bridges, trestles, culverts, etc., consecutively in one direction, also number each pier or bent and span of trestle on bridge of each structure in the same direction. Number stringers and similar pieces from right to left, and stories of trestles from the ground upward. In this way every piece in a trestle or bridge can be readily designated; for example "Trestle 38, pile 3, bent 2," on a road numbering its bridges from east to west would mean—Third pile from the north in the second bent from the east. Actual numbers should be placed on each structure and on each bent or pier. A page in the Bridge-book should be devoted to each structure, on which should appear either a plan of the same or a reference to the standard plan to which it is built, date of building, cost, etc.; and here from time to time should be made a minute record of all repairs, specifying by the above system of enumeration just what pieces are replaced with the date, when cost of replacing same, and any data affecting the condition of the structure, especially records of penetration of piles as driven.

In inspecting trestle work we should ascertain when the structure was built and how much has since been expended for repairs. Its first cost if not known can be estimated, and we may reason that ordinary repairs should at least average one-eighth of the first cost per annum. Any less expenditure implies deterioration and should make us doubt the present safety of the structure unless it be a comparatively new one.

Coming now to the field work, we assume the structure sound and determine whether it is safe under existing traffic, and if so, then ascertain whether the various pieces of timber are sound or need replacing. The stringers should receive very close attention; so also the bridge ties. A stick may often present a fair appearance to the eye and yet be rotten to the core. An expert by sounding timber with a hammer can readily tell from the dead sound where anything is wrong, and close inspection will usually reveal some suspicious looking place where boring or probing with a suitable sharp-pointed instrument will disclose the rottenness if there be any. Excessive boring should be avoided as it tends to weaken the structure. Remembering that where water tends to collect there rot is most likely to set in, we should look carefully to the ends of stringers, especially where corbels are used, also around packing blocks and keys, and caps, and where joints or mortises occur in framed work, etc.

In pile trestles the piles should be rigidly scrutinized at the water or ground line, and tested with a pick or other pointed instrument, and also at any knots or suspicious looking places, and they should be sounded with an ax or maul.

With sill and pile trestles not built in water, the earth should be removed with a shovel to test the portion of piling below the surface and to investigate the condition of sills and mud-sills which may have become covered up by the soil washed down by storms. Bolts and nuts should also receive their due share of attention, and in fact every portion of the structure should be carefully inspected, for in railroad work the safety of valuable property and of human life even may turn upon the failure of a rotten stringer or a rusty bolt, and nowhere is the saying a truer one that "eternal vigilance is the price of safety."

The Highways of Asia.

Mr. THOMAS STEVENS, in describing his bicycle tour of the world, says that the best roads found by him were in British India. One of these highways, known as the Grand Trunk Road, extends for 1,600 miles, from Peshawur, on the Afghan boundary, to Calcutta, "an unbroken highway of marvellous perfection." This excellence Mr. STEVENS ascribes to the peculiar substance used for metalling, a material known as *kunkah*. It is found almost everywhere throughout the Punjab, underlying the surface soil, and is a kind of loose nodular deposit of calcareous concrete which can be readily converted into lime by burning in a kiln.

When this *kunkah* is rolled and wetted it cements together and forms a road surface smooth and compact as an asphaltum pavement, and has excellent wearing qualities. These roads are constantly being repaired and kept in order by native gangs under the direction of the overseer of the district, the worn portions being picked out to the bottom of the metalling and the hole filled by fresh *kunkah* as neatly as if it were a section of a concrete pavement in a city. The material is carried in wooden trays on the heads of the men, from some near-by pit, and the women carry the water in jars; the *kunkah* is spread, the water thrown over it, and another gang tamp it with iron rammers, and they tamp it solid enough "to run a steam-engine over it."

Mr. STEVENS says that next to Indian roads, in point of excellence, come those of Japan, and the 800 miles of Japanese roads traversed by the traveler on his bicycle were found excellent throughout. The Japanese highways are made of broken stone and gravel, or disintegrated granite, and in some places are paved with smooth, matched boulders. He noted that the only bad bit of road struck by him in Japan was between two points lately connected by a railway, and he remarks that the appearance of the iron road seems to bode ill for the maintenance of the ordinary highway.

China has practically no roads at all, as we understand the term. In the south, or the part traversed by Mr. STEVENS, they consist of rough slabs of sandstone, about 6 ft. long by 1 ft. wide, and laid crosswise, and sometimes lengthwise two by two, across and above the level of the rice fields. The thrifty Celestial cultivates his land so close to this road that he frequently undermines the sides, and the stones pitch away from each other like the apex of a roof making traveling thereon exceedingly difficult. Much of the traffic is carried on by peculiar wheelbarrows, and as the coolies handling them usually travel in gangs they get these barrows over all sorts of places by main strength and awkwardness only.

Around about Constantinople the country is yet traversed in all directions by narrow causeways of stone, evidently built for military purposes by the old Romans, Greeks or Byzantines; some of these roads are only 4 ft. wide. In Asia Minor the Turks are now making good macadam roads under the supervision of European road engineers. The work being done in some sections, like Anatolia, Angora and Swas, is simply tremendous, but it is being done by enforced labor without pay for men or recompense for animals used. These too are military roads deemed essential for the salvation of Turkey in the next Armenian campaign with Russia. The Persians have no artificial roads save short stretches about Teheran and a sort of a road between Kasyeen and the capital, of about 100 miles in length.

"IF I REST I RUST," is a German proverb. "If I trust I bust," is the American version.—ex.

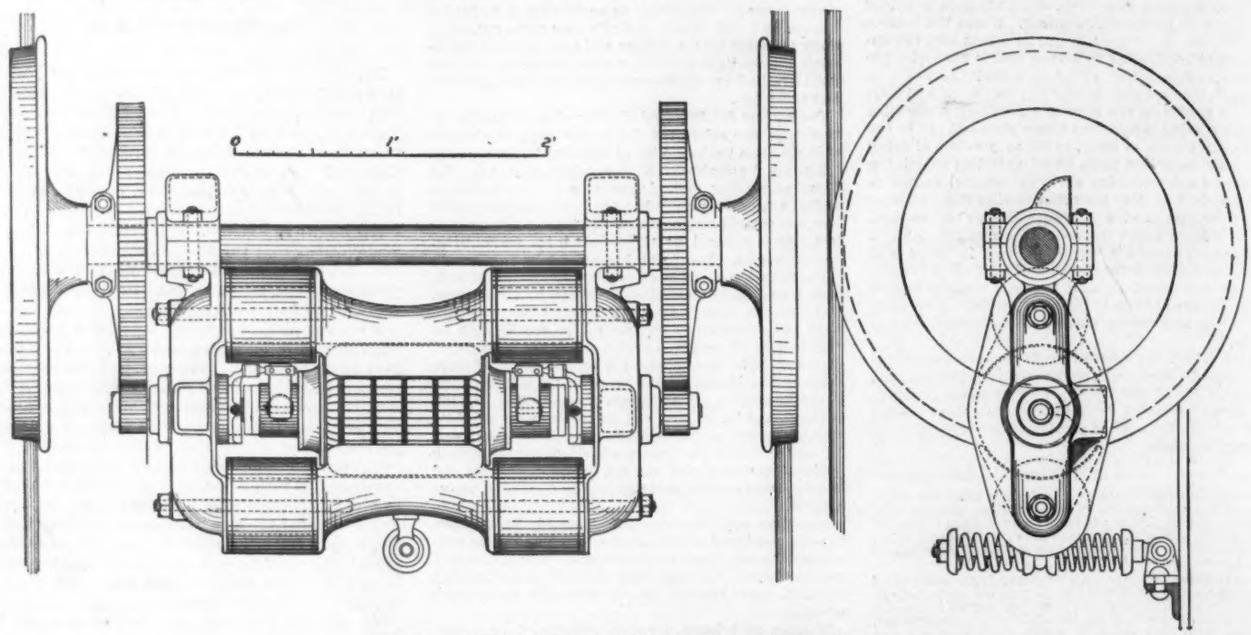
The Sprague Electric Motor on Boston Street Railways.

The first public trial of the new Sprague electric car, which is understood to have been taken up by the West End Street Ry. Co. and which we illustrate this week, was had Monday afternoon, Oct. 10. A short test was made in the car house of the Cambridge Railroad on the previous Saturday evening, and the storage batteries were recharged by wires from the Cambridge Electric Light Co. At precisely 3.30 P. M., the appointed hour, the car was started, with forty-four gentlemen aboard, including the Presidents of the Metropolitan and Cambridge roads, representatives of the West End Co., engineers, electricians and representatives of the Boston press. The car ran without the slightest apparent difficulty, and at about the ordinary speed of a street car, to the Charles river bridge, thence to Harvard square, a distance of nearly 3 miles, and from there to the Mechanics Exhibition in Boston, about 4½ miles, in about 45 minutes time, including several delays. On this trip hills of about 3 per cent. grade were readily climbed, and the car stood the racket without apparent detriment of running for some distance off the track, as the flanges jumped the track owing to defects in the latter or some other cause. The entire trial was fairly comparable to ordinary running conditions, and was, to all appearances, successful. The motors, two in number, weighing together 1,400 lbs. and geared directly to the axles as shown, the connections with the car-body being by a yielding spring attachment which prevents a sudden strain from injuring the gears. The storage battery is of the Julian form and consists of 120 cells weighing about 30 lbs. each, or a total weight of 3,600 lbs., which, added to that of the motors, equals a total additional weight of the electric apparatus to the car of 5,000 lbs., or 2½ tons. The car is especially built for the purpose, and does not differ from the common closed street car except that the inside floor is raised by a step of 6 in. above the platform level, which enables a stronger form of framing to be employed than in the ordinary car. The storage cells are placed under the seats, access being had to them from the outside by hinging the boards forming the sides of the car. In the car house are long tables at the level of the receptacle thus formed, upon which the batteries can be easily slid upon lubricated iron ways for recharging.

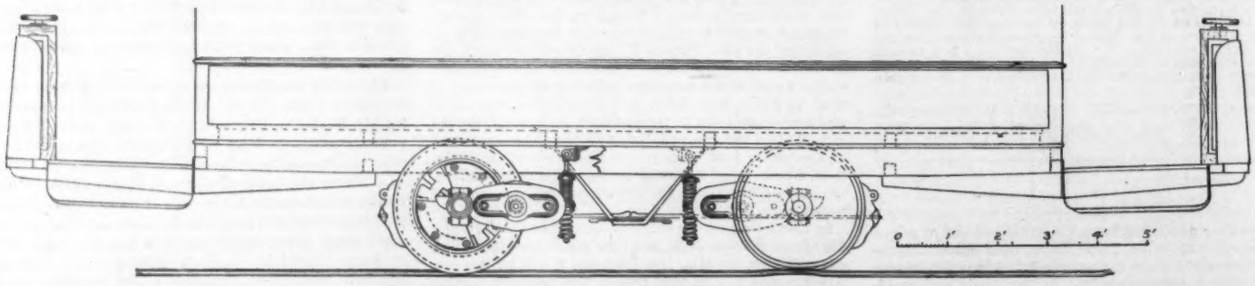
The New York test of this car was at a maximum speed of 12 miles per hour, with 15 persons on board, and power sufficient to climb a 6 per cent grade. As this electric power is so new to most engineers engaged in other branches than that of electricity, it may not be amiss to state how such power is figured. The analogy is most perfect between water power and electric power. Electric pressure is measured in volts, and is cumulative as the cells are connected for street car propulsion. That is, each cell has a potential of about 2 volts and the 120 cells would therefore have 240 volts of potential. The current corresponds to quantity (as of water) used, and is measured in units called *ampéres*. The current flowing from a storage battery depends upon the amount of power required to move the car. A small instrument, called an ampérmeter, is fixed beside the car driver, which shows the current being used at each instant. As this varied between 15 and 18 ampéres it should, by a simple calculation, be the horse-power that was exerted to have been between 5 and 6. For, taking the current at 15 ampéres, multiplying by the number of volts 240, gives 3,600 volt ampéres, and dividing this by 746, the number of volt-ampéres equivalent to a horse-power, 5 is obtained. The car will use in seven hours running about 20 per cent. of the electricity stored in the cells. The charging current was about 20 ampéres and as the car expended the energy at about the same rate it requires about the same time to recharge this amount. As the car was geared for power, that is, to climb 6 per cent. grades with a full load, the speed was limited to about that of a common car.

The driver controls the movements of the car by means of a vertical lever attached to each dashboard and which, moved to the right, throws succeeding sections of the battery into connection with the motors, and to the left cuts them off. The car is lighted by chandelier and end incandescent lights, and fitted with an alarm gong also operated by the electric current.

The engineering field opened by the commercial success of the electric motor on street railways alone, is a very large one, and we shall revert to this subject more fully in early issues. The time is near at hand, if it is not now, when every engineer who would keep abreast with the times in the discharge of his duties, must have a clear understanding of the elements of electrical engineering at least. A great number of people are now working over the problem of electric street car propulsion, some of whom, who have made little noise in the public press as yet, have devices of the highest promise. We think it extremely probable that very much better than this performance will be done ere long, but in the meantime, we may well be thankful that so much has been already accomplished.



The Sprague Electric Street Car Motor; Plan and Elevation.



The Sprague Electric Street Car Motor; General Elevation.

IT is announced that England has granted an annual subsidy of £45,000 to the Canadian Pacific Railway Co. for a monthly mail service to Vancouver, China and Hong Kong. But in return for this, the railway company not only agrees to carry the mails to China more quickly than they can be otherwise carried, but to build, equip and maintain a fleet of vessels that will be available in case of war as armed cruisers, and thus add considerably to the strength of the English squadron in the Pacific. This looks like a pretty wise move all around, both from a British and Canadian standpoint.

Replacing the Conestoga Bridge, Pennsylvania R. R., with Stone Arches.

The Conestoga bridge crosses the creek of the same name, near Lancaster, Pa., on the main line of the Pennsylvania R. R. Along with other bridges on the same road, the iron spans are to be replaced by stone arch masonry and the old structure was shifted on to temporary trestles on Sunday, Aug. 7, last, as before mentioned in our news columns. The method of doing so is here illustrated and described.

Fig. 1.—Conestoga Bridge, Penna. R. R.; Temporary Trestles.

The old bridge was a double-track structure, 349 ft. long, and it weighed in total 450 tons; the rails were about 60 ft. above the water-level in the creek. Temporary trestles and trestle-piers were first erected parallel to the bridge, as shown in Fig. 1, and when these were completed preparations were made for shifting the iron trusses to these new supports and carrying the traffic across upon them during the erection of the masonry arches on the old bridge site.

The three trusses were first jacked up over the piers about 10 in. and the two bars of steel rail inserted under them, (heads down) as shown in Fig. 2, and a 1×7 in. iron plate put upon the pier as a bearing for the rollers to be used. These trusses were stiffened laterally and the weight distributed over the rollers by the 7×14 in. timber struts and sill shown. On the trestle-piers two other lines of rail were laid about 2 ft. apart (heads up) for each truss and with the top of the rail just flush with the iron plate on the pier (see Fig. 2). When all was ready, sets of 3-in. iron rollers, spaced 14 ins. apart, were put between the inverted rails under the trusses and the plates on the piers. The motive power for each truss was supplied by a crab located on an extension of the trestle-pier, and the hauling fall was made fast to the center truss of the bridge between the first and the second post. A triple and a double block were used, the first fast to the bridge and the second to the trestle just in front of the crab. In all six crabs were used with four men to each. Fig. 2 shows sufficiently well the dimensions and general arrangement of one of the trestle-piers without further description.

The actual work of moving the trusses to the trestle was accomplished on Sunday, Aug. 7, under the watchful eye and expert supervision of Mr. WILLIAM K. BEARD, Master Bridge-builder of the Pennsylvania R. R. He had 63 men to assist him and within 15 minutes after the track was cut the entire structure was moved over 44 ft. 6 in. to its new and temporary position. The rails were again connected with the main line and traffic was resumed within 80 minutes from the first break of track. The whole operation was performed without the slightest hitch or halt, and both the method and the executive ability displayed by Mr. BEARD in carrying out his plans entitled him to the greatest praise, and we are happy to hear that his work in this case has been properly appreciated by the higher officials of the Pennsylvania R. R.

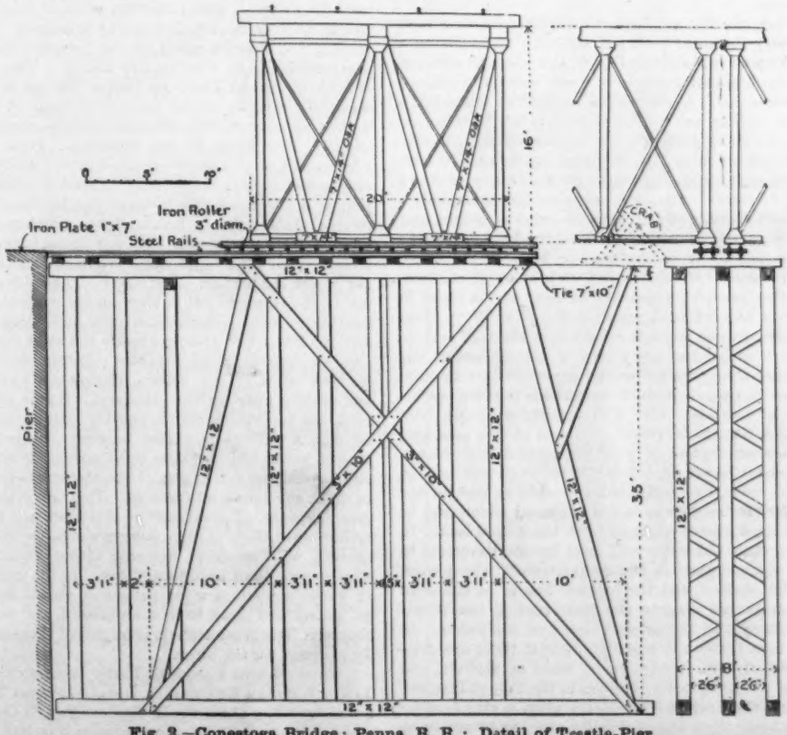


Fig. 2.—Conestoga Bridge; Penna. R. R.; Detail of Trestle-Pier.

Effect of Detonating Gun Cotton on Iron Plates.

Prof. C. E. MUNROE, of Annapolis, Md., an acknowledged authority upon explosives, has been making some interesting experiments upon the reproduction, by the force of the explosion, of characters cut upon the face of cylinders of compressed gun-cotton used.

An old theory was that the gases produced in such a detonation retained for an instant the exact form of the original mass and by this means reproduced any figure on the face of that mass. This theory is now refuted by the fact that a plate of iron, for example, placed under a cylinder of gun-cotton which has characters sunk in its face, will show when the cotton is exploded corresponding depressions and, not marks in relief as was once supposed. Prof. MUNROE proves this conclusively by his experiments.

He used the regular service gun-cotton compressed into cylinders, or cubes with truncated corners, 3½ in. in diameter on side and 2 in. high in each case. Through the center of each cylinder or cube is a hole for the reception of a cap of mercury fulminate.

The iron plate experimented upon was about ⅛ in. thick and 5 in. square and rested upon a heavy iron plate. The block of gun-cotton was laid on the smaller plate and fired by an electric current passing to the detonator placed in the central opening. The following are some of the results:

The cylinders of gun-cotton used have sunk into their face the letters U. S. N. and the year of manufacture. When these characters were brought in contact with the iron plate and the charge fired, a saucer-like depression in the plate is made, the letters and figures reproduced with great exactness, but in *sunken* characters as in the original, and the hole for the detonator in the center of the mass produces another depression in the iron plate. In fact the final result was the exact reverse of what would be anticipated. In further experiments, grooves cut across the face of the cylinder reproduces grooves on the plate with exactly the same roughness of surface and irregularity of outline as in the original. Tests were then made with extraneous marking and in the first of these a piece of wire gauze was put between the plate and the block of gun-cotton. The result was that the gauze was entirely destroyed, but the openings produced depressions and the interwoven wires were reproduced in relief.

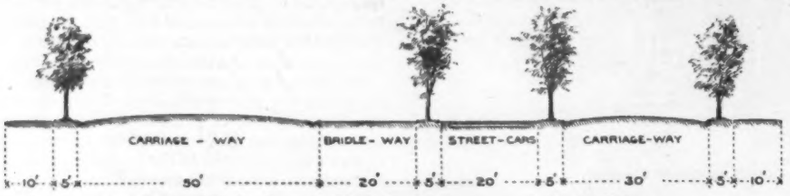
When the cuts or characters in the gun-cotton were filled with vaseline, however, no impression of the letters was produced. As showing that the peculiar effect observed is only produced by the surface of the gun-cotton, the test was made of using a second plate of iron upon the lower surface of which etters were cut. When this plate was laid upon the first, face down, and a cylinder exploded upon both, it was found the action was the same as that of a die and blank in a coin press; one plate was driven into the other but the sunken marks were reproduced in relief. Experiments were then made with soft bodies by first placing a couple of green leaves between two plates and gun-cotton detonated upon the pair. The result was a faint but very exact impression of the leaves on both plates. Next a single green leaf was placed directly under the cylinder of gun-cotton, and in this case the ribs and outlines were all sharply defined in relief on the iron plate.

In explaining these peculiar results, Prof. MUNROE says that a theory was originally advanced, based upon the first experiment, that the observed effect was due to the indisposition of air to suddenly change its form when exposed to compression. This explanation fails, however, to account for the action of the wire gauze. The author believes that a more probable theory can be derived from the projectile force of the gases of explosion. This kinetic energy being assumed as capable of violent action upon the iron, then the gases released from excavations have a larger range and consequently a higher force of impact. Or, the gas force may be in proportion to the surfaces of emission, and hence an excavation would have a larger area of action than a flat surface. It is possible that these two causes may be combined in producing the effect noted.

NEW South Wales proposes to commemorate its Centenary by erecting a giant female Phăros on Sydney Heads, borrowing the idea from Bartholdi's statue in our harbor.

Boston's West End Improvement.

The West End Land Company, of Boston is carrying out an extensive improvement of Beacon street between the Back Bay Park and Chestnut Hill reservoir, a distance of about 3¼ miles. Starting as a land company by purchasing some 5,000,000 ft. of land in Brookline, including about one-half the frontage on this section of Beacon street, it was found necessary before permission could be had for a double track horse railway through the street to undertake its widening to a broad boulevard, 160 ft. wide, for the most part. Again, as there was difficulty in obtaining a good entrance for the street railway to the city proper, the members of the company formed a syndicate to purchase control of the Metropolitan and South Boston street railway lines, and afterwards extended their control to the Cambridge and consolidated roads all of which are now included in the West End Street Railway Co. These enterprises have both been vigorously pushed, the railway consolidation being already successfully accomplished and a large portion of the work of widening the street in process of execution. The entire work will take about two years. To date, 100,000 cu. yds. of the whole 160,000 cu. yds. of earth to be moved, have been excavated and filled. The avenue is to have a width of 100 ft. for a short section in Boston and 160 ft. for most of its length, and as the old street passed over a succession of hills and valleys, the location being in a rolling country, much work was required in bringing the new avenue to a uniform easy grade for driving. The work is in charge of ASPINWALL and LINCOLN, chief engineers, who have had considerable previous experience in laying out streets upon the Aspinwall land property, and in sewer and sanitary work. About 200 men and 65 horses are employed on the grading work, the Boston & Albany Railroad doing considerable of the filling by gravel trains. Water pipes are already in and the sewer work, varying from 8 in. pipe to brick tunnel 48-ins. × 70-ins. nearly completed. The work included the moving off of numerous buildings, and putting in the pipage and grading and was rendered more difficult by the necessity in most places of keeping the way open for traveling while the work was going on, as the street is the highway between Boston and Newton. Thus far but little rock has been struck, not more than 100 cu. yds. in all, the material being hard gravel. This avenue, when completed, will compare favorably with any of the great boulevards of the world, such as the Berlin Unter den Linden, the Ringstrasse of Vienna, or the Avenue of the Bois de Boulogne, of Paris. The sectional view shows the arrangement. The double line of street railway tracks laid with the English grooved rails, which we showed in a recent issue of this paper and which it is the intention to operate by electric motor, if possible, occupies nearly the middle portion for a space 20 ft. wide. On each side of this is a strip of turf, 5 ft. wide, in which are planted rows of trees. On the left of this, looking from the Boston end, there appears successively a 20 ft. bridle way, a 50 ft. driveway, another similar turf strip with row of trees, and 10 ft. walk. On the right of the space reserved for the railway tracks is a turf strip, a 30 ft. driveway, turf strip with row of trees, and a 10 ft. walk. The avenue will thus have four rows of trees and strips of turf, two driveways and a trotting pad, besides the railway lines. At two points, at least, the avenue will expand into a circle, or open space, and crossing places for the driveways across the tracks will be made at intervals. The driveways are to be macadamized in the best manner; the gutters and railway space paved. The railway track laying will be begun about Oct. 15. The improvement, though a private enterprise, will be in the nature of a substantial addition to Boston's fine system of parks, which we fully described in our issue of Aug. 27.



Beacon St. Boulevard; West End Improvement, Boston, Mass.

"Notes on the Detection of Leaks in Water-Mains."*

New River Company.—Mr. JOSEPH FRANCIS, M. Inst. C. E., says that the pipes of this company generally lie in clay, and the water escaping from any defective place is at once directed towards the surface. Even where the stratum is gravel it is usually of so compact and loamy a nature that the effect is practically the same. A leak, therefore, most frequently shows itself immediately over the weak place, even though there may be concrete and asphalt above, the water having a tendency to filter through the concrete and to force up the asphalt covering in the form of a blister. Occasionally, however, it is first seen at some distance, having crept along the side of the pipe to a place where the filling-in above may happen to be loose, or of a nature more easily penetrated. Or, it may travel along the under side of the paving until some point is reached where the continuity of the outer skin is broken, as at a kerb, a gully, or a house-front. In such cases the leak is found by digging down at the various pipe-joints until the right one is discovered. Where there happens to be a sewer in close proximity, the water may find its way in and thus attract attention.

Undoubtedly an impermeable surface to a road greatly increases both the difficulty of localizing a leak in an underground pipe, and also the amount of damage that is likely to occur before the evil can be remedied. A successful method of following a leak having an underground exit has been to remove a small portion of the surface covering in several places near the suspected spot, and to bore down to the required depth with an auger of 2 or 3 ins. diameter. The escaping water has necessarily a certain amount of fall from its point of origin, and consequently stands highest in the hole nearest to that point. By boring further holes in the direction indicated the site of the leak is at length reached.

With regard to the arrangement of the pipes in streets covered with concrete, the New River Company spares no pains to ensure that the iron may lie on a solid bed and the joints be soundly made; but further than this no special arrangements are provided for the detection of any leakage that may occur.

East London Water Works Company.—Mr. WM. BOOTH BRYAN, M. Inst. C. E., says of this company that where asphalt or wood pavement is laid leaks in water-mains are exceedingly difficult to localize. In some cases, the water being unable to rise to the surface forces its way into a basement which may be at a considerable distance from the actual leak. In other cases the water will force up the pavement in the weakest place in the neighborhood; the ground is then opened, and the leakage has to be traced to the fractured pipe, to the great cost of the Water Company and the inconvenience of the public. In the East London Company's district there are comparatively few roadways of wood or asphalt, and these are principally situated in the City of London. Where ordinary pavements are upon a clay foundation leaks show almost exactly over the fractured or faulty pipes. In the neighborhoods of Bow and Old Ford, and many other places in the East End, the subsoil is gravel, and leaks do not always show on the surface, as the water passes away without detection into deep sewers and elsewhere. In these cases leaks are difficult to localize. If the supply to the houses near is insufficient the cause is sought, and sometimes a length of pipe has to be uncovered to detect the fault. The East London Company uses Deacon's waste-water meters, and also "stethoscopes" the pipes at various places. These methods frequently enable the leaks to be localized. In this company's district the pipes were mostly laid anterior to the introduction of concrete pavements, no special arrangements having been taken, but great care exercised in jointing the pipes, which are run with lead. A novel system has been introduced for detecting leaks on a particular service, which so far has proved more successful than anything else. It is simply the employment of a small "by-pass" of ⅛ or ¼-in. diameter, spanning an ordinary sluice, cock. The sluice-cock on the service-pipe, supplying fifty houses, more or less, and in some cases one hundred houses, is shut, and the by-pass opened. It is known how much water will pass through the by-pass, and that it is sufficient for all the needs of the consumers. If then complaints of insufficient supply are made, it is evident that there must be either waste or leakage, and a visitation is made to all the houses. If the fittings are good, there must be a leak somewhere, and the site can generally be ascertained by listening at various points, or by boring with an auger.

Grand Junction Water-Works Company.—Mr. ALEXANDER FRASER, M. Inst. C. E. says that there are but few streets in this company's district laid with asphalt, and not any subways. Until recently the streets were paved with granite sets laid on concrete or gravel, or with broken granite (macadam), or simply with gravel. In either case, when a leak occurs it soon asserts itself on the surface, and the exact site is readily found; moreover the escaping water runs down the gutters and gratings into the sewers. Now, however, the practice is to take up all the macadam and mix it with Portland cement into a concrete, which is spread evenly over the whole surface of the road about 6 in. thick. On this wood blocks are laid. The substratum of the greater part of this Company's district is clay, but it is traversed by sewers and drains, and most of the houses have basements, and also cellars under the pavements. So when a pipe bursts, or a leak occurs, the water finds an impermeable ceiling above, and the pressure drives it either into the sewer or into some basement or cellar, whichever may be nearest. Great trouble and expense result, as the Company usually compensate those who receive injury. Moreover, should the street be on an incline, the water runs downhill from the actual point of leakage. This is a great annoyance. The leakages into the sewers are usually discovered by the sewermen. Some few years ago a case in point occurred in Oxford Street, on the incline near Bond Street. A cone suddenly appeared in the wood pavement at the bottom of the incline about 3 ft. in height, from which a small quantity of water issued. This was found to proceed from a ½-in. pipe supplying a drinking-fountain at the top of the incline. The water had accumulated under the concrete till it blew up the surface. On another occasion a 30-in. main burst at Notting Hill, and the water not finding a ready outlet at the surface, on account of the concrete substratum, forced its way laterally into cellars, basements, kitchens, and finally blew up the pavement. It cost £500 to reinstate everything and to pay the proper compensation. A serious objection to wood pavement is that so much of it requires to be opened up and relaid beyond the actual size of the opening necessary to effect the repair of the pipe. This is a source of great expense. The officials of this Company are of opinion that there is more danger where the road is covered with concrete, carrying either asphalt or wooden sets, than in ordinary cases. In the interests of water-companies wood pavement should be laid on gravel and sand well consolidated, and not on concrete. Wherever asphalt is employed there should be subways for the pipes.

Southwark and Vauxhall Water Company.—Mr. JAMES WILLIAM RESTLER, M. Inst. C. E. says: There are many miles of streets in this company's district paved with asphalt, wood, or granite sets laid on a concrete foundation, also wood blocks laid on cross-timbers. In all these cases the greatest difficulty is experienced in tracing leakages, owing to the distance often traveled by the leak before it shows on the surface, or in the basements of the houses. This difficulty is often increased by the water getting into disused surface drains, numbers of which exist in the older portions of the district.

The pipes are laid without special reference to the distance from the houses. The usual practice is to place them in the roadway at about 3 ft. from the curb, but this cannot always be done in the main-roads, owing to the number of other pipes for gas, water and telegraph purposes. The pipes used by this company are of iron, cast vertically, and jointed with lead. The nature of the ground varies con-

* From Selected Papers; Institution of Civil Engineers.

siderably in different portions of the district. In nearly all cases any considerable leakage forms a great cavity under the concrete, which rarely gives any intimation of its existence. In some cases leakages from pipes 4 in. in diameter have occasioned cavities which required 18 cu. yds. of material to fill them up. An important aid to the detection of underground leakages in pipes up to, say, 7 in. in diameter, is afforded by Deacon's waste-water meter. These are used by the company in all districts that are under constant supply, and whenever a leakage occurs the meter indicates its existence, and the approximate amount, on the diagram. The leakage is then localized in the following manner:—Between the hours of midnight and five A. M. (when it is assumed that no supply is required) each of the cocks commanding the branch-pipe leading to the side streets is shut at a time agreed upon. The following morning the diagram from the meter of the district is returned to the office, and it is then seen at a glance (by comparing the diagram and the time-sheet) in which street the leakage exists. In order to show its exact position in the street, a further inspection is made on the following night. This is confined to the particular street. The small cocks on the house-service pipes are in the first instance all shut off, and the inspector then applies a steel bar to the various main cocks and hydrants. By carefully listening, he can, from the sound made by the escaping water, determine with great accuracy the position of the leakage.

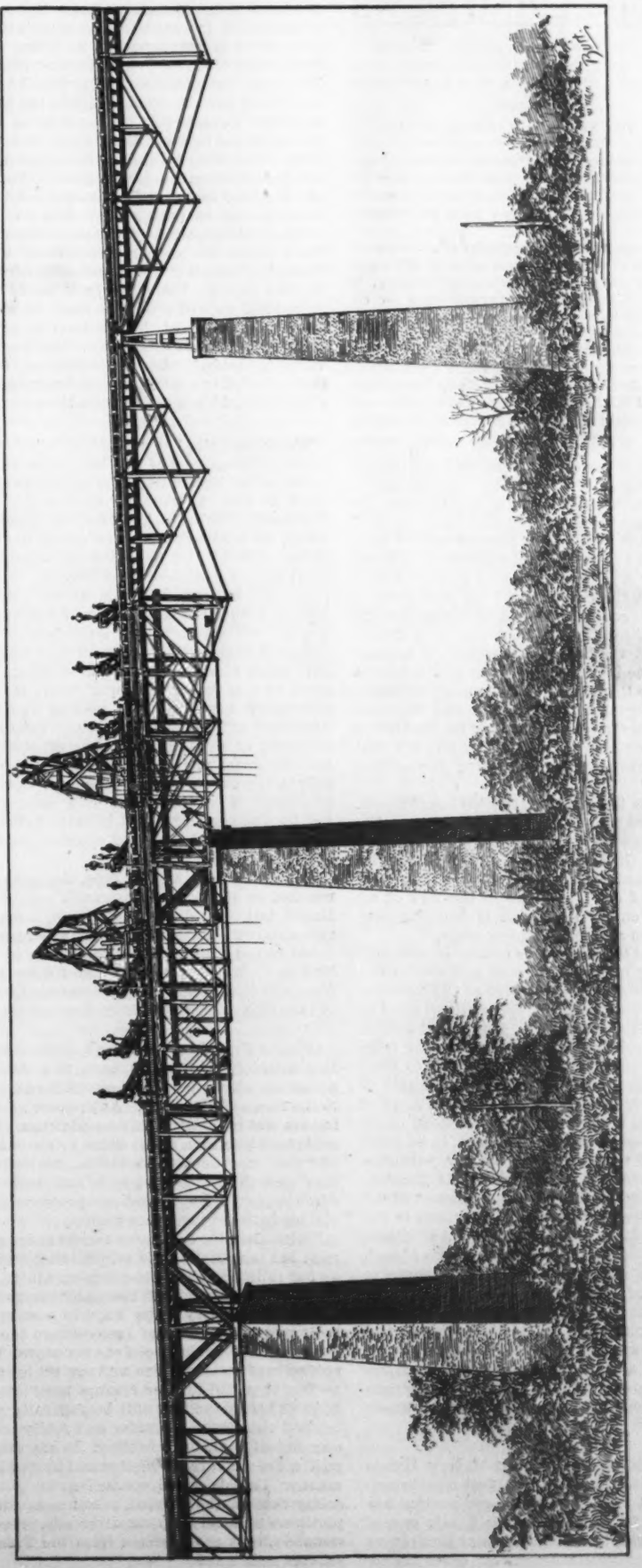
Changing the Trusses of the Appomattox High Bridge.

The Appomattox High Bridge, with the Fink trusses, shown to the right of the accompanying illustration, was erected by SMITH, LATROBE & Co., of Baltimore, Md., in 1869 on the South Side R. R., (now Norfolk & Western R. R.) Under the increase in loads in the last twenty years, the bridge became too light for modern service, and last summer Mr. FREDERICK H. SMITH, the successor to the original builders, replaced its 21 spans of 112 ft. each of Fink truss with the same number of spans of steel and iron Pratt trusses.

This change of trusses was made practically without stopping traffic, and the method devised by Mr. SMITH is shown in our engraving. He used a "carry-span," or a movable span of 112 ft. in length which supported the new trusses during erection, and carried the traffic in the interval of change of truss. This carry-span had wooden top-chords and posts and iron bottom-chords and diagonal ties; the lateral bracing was removable, and when thus stripped of the latter members the whole span weighed less than 40 tons. Our engraving represents it being carried from one span to another. This was done by means of 14 screw-rods, 1⅛ in. diameter, running up through the top-chords to seven pairs of heavy cross beams resting upon as many push-cars, or trucks, on the track above. The carry-span was thus transported to its new seat over the piers, then let down by the screws into place, and the cross-beams taken from the cars and passed under the chords of the iron span, and above the chords of the carry-span. The iron span was then blocked up on these beams, and then taken out, and the new Pratt-truss erected in its place under the cross-ties. Two traveling rigs enabled the engineers to work four gangs at one time.

The carry-span was proportioned with a safety factor of 5 when carrying its own weight the weight of the new bridge and a train of locomotives combined. The force was handled by Mr. JOHN KANE, and in less than 60 days, all told, and in 49 days of actual working time, he changed the 21 spans from Fink to Pratt trusses, without falseworks other than shown, and without serious interruption to traffic. The operation of transferring the carry-span from one pair of piers to the next consumed less than 90 minutes time, and this was the only time during which the track was flagged. He completed a span and moved along to the next every two days after the men got the hang of the new rig.

It was this same Mr. KANE who last spring removed for Mr. F. H. SMITH ten spans of 170 ft. each, of Howe truss, at Harrisburg, over the Susquehanna river, and accomplished his task in 68 working days. We acknowledge our indebtedness to Mr. FREDERICK H. SMITH, Consulting Engineer, of Baltimore, Md., and the successor of the Baltimore Bridge Co., for the photograph from which our illustration is made and the data from which this description is made up.



The Appomattox High Bridge—Changing Trusses.

ENGINEERING NEWS

VOL. XVIII. Saturday, October 22, 1887.

D. McN. STAUFFER. A. M. WELLINGTON.
EDITORS.

GEO. H. FROST, - - - BUSINESS MANAGER.

Subscription. — UNITED STATES AND CANADA, $5.00 *per Year*; $2.50 *for Six Months*; $1.50 *for Three Months*; *Single Copies*, 12 *cents*. FOREIGN COUNTRIES, $6.56 *per Year*, or 3 *cents per number additional.*

Drawings and Photographs *of all new engineering works or designs, large or small, of interest from their magnitude, novelty or originality, as well as newly adopted* **Standard Plans** *for engineering structures or details, rolling stock, etc., are always desired for early publication. Also* **Brief Technical Notes** *of the cost or manner of executing work, tests of materials, machines or other new devices, and* **News of New Construction** *of all kinds.* **Letters** *for publication must be accompanied by the name or card of the writer.*

AN intimation comes from official quarters in Washington, D. C., that our Government is quietly investigating on its own account the Barker concessions in China and the reported interference with these concessions by rival commercial powers, It is apparently believed that vigorous efforts are being made in China to prevent the execution of the provisions of the Barker concession, both by foreigners and the opposition Chinese element. It is understood that the State Department is anxious to know the inside negotiations and influence that led to this rather extraordinary advancement of American commercial and financial interests in China, and just how far the United States is indirectly interested by any act that may be construed as supporting the parties concerned.

The main issue in this reported interference, and the one that the Washington despatches say is to be especially attended to is—whether or not our Government will permit foreign intrigue, based upon motives of commercial rivalry and envy, to stand in the way of an American enterprise which is honestly conceived upon a purely business basis.

The chief trouble in this matter of commercial rivalry is that all great nations, saving our own, keep representatives at the commercial centers of the world especially trained in intrigue of this character. It is their business and we certainly can expect nothing else from them. The only apparent remedy is to meet fire with fire, and to follow the example of other powers in maintaining abroad a corps of skillful and trained diplomats, instead of regarding these positions as a place, to be filled for a brief term of office by any politician who deserves well of his party. As Englishmen look out for England and German diplomats care for the interests of Germany in the various capitals of the world, so Americans, equally skilled in the current methods of such work, must watch over American advance in other countries. This is especially essential when we have to deal with a people as conservative, suspicious of outside interference and cunning as are the Chinese. In short, we can hardly pick a quarrel with our European rivals because their representatives are sharper than our own and succeed in doing that in which we fail from lack of the proper tools.

THE legislature of the State of New Hampshire, after the sharpest and most closely contested fight and the longest session that has ever occurred at Concord, has finally passed the Hazen bill, by which the legal hindrances to railroad consolidation in that State are removed. The effect of this bill is to allow the Boston & Maine system to obtain the control of nearly all the roads of the State within a short time, in pursuance of its plans which have been before referred to in these columns. The numerous charges of bribery and corruption which have been made against the Boston & Maine managers do not seem to us to be proved by the investigations which have been held. Hon. FRANK JONES of Portsmouth, who has been the commanding general of the Boston & Maine forces, stated frankly before the investigating committee that men had been employed to explain to legislators the advantages which his corporation offered to the State, but that they had no authority whatever to offer bribes. Undoubtedly it would be a more ideal state of affairs to leave legislators wholly uninfluenced; but as long as private individuals and organizations of every sort invariably "lobby" when their interests are at stake, we fail to see why railroad corporations should be held to a higher moral standard.

We are surprised to notice that some of the leading newspapers of this city denounce the action of the New Hampshire Solons as calculated to "fix the fangs of monopoly" upon the State. Probably, however, the articles to which we refer were from the pen of the "political editor;" for it is always popular to howl at and denounce corporations. We believe that the consolidation of the roads of northern New England under the Boston & Maine, will result to the advantage of the people of that section. The attempt which is still made almost everywhere to secure low rates by competing lines will result in only temporary advantage, for pooling and consolidation are bound to continue. The establishment of a permanent scale of equitable and impartial rates is to be affected, not by silly attempts to keep railroad corporations in a state of continual war with each other, but by a much larger and broader definition of the rights and duties of common carriers than has ever yet been made.

Since the above was in type, the news has reached us of Governor SAWYER'S veto of the Hazen bill. We do not anticipate, however, that this will cause more than a temporary delay in the fulfillment of the plans of the Boston & Maine managers. And we see no reason to change our views as stated above of the benefits to be deived from their success.

CERTAIN French corporations, instigated by late disasters in theatres, have now devised a plan of accident-insurance especially adapted to the needs of playgoers. Any person in buying his seat has only to pay an additional two cents to entitle him, or his heirs, to an indemnity that may amount to $2,000. As Frenchmen are a theatre-going people and accidents don't happen often, the scheme promises good dividends to the insurance company.

Fortunately for us theatre accidents are also rare, but in applying this scheme to traveling on our railroads during the coming winter, we would advise the accident-insurance companies of our own country to be wary in scattering their policies on lines of roads where the directors persist in the use of the car-stove. The epidemic of accidents has already set in, and we fear that still further horrors must crowd upon us before the fact will be generally recognized that there are safer and really more economical methods of heating. In any event, until all of our cars are lighted and heated in a manner that is more conducive to public safety than is the present practice, accident policies will hardly pay the dividends, proportionately, that are expected from the French scheme mentioned.

IF the clerk of General Manager BROUGHTON, of the Chicago & Atlantic R. R., was authorized to act as the mouthpiece of that corporation in his statement that the details of the Kouts' accident were "none of the newspapers' business and none of the public's business," it is time that the clerk and the company were both undeceived. The fact remains, however, that the railroad company has succeeded only too well in covering up the attendant circumstances and conditions, and even at this date the public does not certainly know whether ten lives or thirty were sacrificed in the burning wreck.

This extreme secretiveness and insolence, on the part of the corporation, will react upon its own head in good time, and it will eventually discover that the public and the public press is hardly a safe thing to ignore or insult. The act in itself is a confession of blundering somewhere, for which they are responsible, and they can expect little mercy when the facts come out, as they surely will. The only incentive for such conduct is to save money in consequential damages, and to hide the facts is to admit that they would have to pay if found out. We hope they may, and pay roundly too.

WHETHER chargeable to late serious disasters, and a consequent demand from a too long patient public, to our general rapid advance in all things, or simply to a realization that a change of policy was well from a business standpoint, we know not. But the fact is apparent that an era of better practice is setting in among our railroads.

The grade-crossing must go; electricity is being substituted for the oil-lamp; steam-heat from the engine is to replace the car-stove that has been the cause of so much horrible suffering in every winter wreck; automatic couplings and air-brakes of the most approved form are to reduce the mortality among those who have for so many years risked their lives upon our freight trains, and in fact, in every direction, we see evidence that advance is not only being earnestly studied but enforced by laws, which we hope were not made to be broken.

While these many improvements upon past practice seem to crowd upon us together, they come none too soon. In the case of the grade-crossing there is some valid excuse for their past existence in the manner in which our railroad system was commenced and the conditions under which it grew so rapidly. In the majority of cases expensive overhead, or sunken crossings meant an expenditure that the new company could, perhaps, ill afford; and in many other cases the necessity for such precautionary measures is the outgrowth of the population that followed the road itself, and which did not exist when the iron rails were first laid down.

But conditions have now changed, and it is to the interest of both railroads and towns that grade-crossings be done away with entirely. But we do not agree with those who would have the company pay all the cost of change. To the railroad company an accident only means dollars paid for damages; while to the community it means loss of human life. The town has really the greater interest at stake, and can usually well afford to pay its share for an improvement that may save the railroad some money eventually, but meanwhile renders the lives of its citizens more safe.

IN answer to several enquiries we would state that the address of the Nicaragua Canal Co. is at Room 56, No. 36 Broad street, New York City.

Letting Professional Work to the Lowest Bidder.

Probably contractors who have experienced the sharp competition and whittling of profits which occurs when a well advertised piece of work is let, will notice with interest that, judging from letters in our correspondence column of the present issue and one of a recent date, there is a growing tendency, in some sections of the country at least, to put the work of engineers on the same footing as that of contractors, and let it to the lowest bidder. And if contractors who, after figuring their bids down to actual cost, have been unlucky enough to have their work measured and inspected by an engineer who supposes his whole duty toward the contractor is to howl at every defect in his work, real or fancied, and cut down his measurements and compensation in a way beyond all reason and equity,—if such contractors do not feel many twinges of sympathy when they hear that such an engineer is likely to experience in his own affairs the blessings of sharp competition, we cannot say that we shall blame very deeply the dealer in excavation and embankment.

But, seriously, is there a movement toward this sort of competition? Is professional work to be done by the lowest bidder? We think not; at least after a few "economical" corporations have had time to study the results of selling professional work at auction. Judging from our correspondence, the attempt will be made now and then, just as the City of Toronto, some months since, tried to obtain a city engineer on a somewhat similar plan. Engineering, like any other profession, is open to competition, and especially in the lower grades; but this competition is usually of a character that in nowise harms the engineer or the corporation. Some decrease of monthly salary, for the beginner, is its chief effect, and this is offset by other consideration as, pointed out by us in our issue of Aug. 20.

But advertising for engineering brains and estimating their capacity at the valuation put upon them by the bidder, that is, the lowest market price, is about as wise as advertising for sealed proposals for medical, or spiritual treatment or legal advice. In either case it is the advertiser that will ultimately suffer, in pocket, health, or spiritual and worldly affairs.

Labor that may properly be subjected to this class of competition, is that in which the competing parties cannot stand to any great degree on a different footing, and in which the work to be done may be so clearly and explicitly stated in a written contract, that a person of suitable intelligence may determine whether the work has been performed in accordance with its terms. Most emphatically the professional work of the civil engineer does not come under the above description, and, in this connection, a quotation from a private letter from the writer of the letter in our correspondence column is pertinent: "There seem to be no resident engineers, and the location is doubtless a wonderful one, there being in one place a 26 ft. fill, 1,500 ft. long, which a slight change from the rough preliminary, which is all the so-called location amounts to, would have reduced to little or nothing. I think you will be curious to know whether it is possible for a line so located to be a paying investment." This last query is exactly to the point. According to our correspondent, the engineer who has the contract for locating this road, has done work by no means good or thorough, though we presume he has, like MARK TWAIN'S Mississippi pilot, given his company their money's worth of location. But who shall decide that his judgment was faulty? A company who are so economical (?) as his employers, will not be likely to go to a consulting engineer to find if the work done is good or bad. And even if they did, this man has performed his contract in good faith if he has located the line to the best of his ability, and he will not consent to have his work thrown out because, forsooth, somebody thinks it might possibly have been better done. His employers themselves have not the professional knowledge to know whether the work be good or bad, and it is not until in after years, as our correspondent hints, that the unrelenting statistics of the fixed charges and operating expenses explain to them that there has somewhere been an error in their business calculations.

It is hardly necessary here to refer to the low valuation of engineers as professional men by the directors who would sell their engineering work in the manner objected to. In the first place they do not know what it is that they want to buy; and in the second place they, or their victims, buy the cloth and must wear the coat, even if it does turn out to be worthless. No good engineer, except from dire necessity, would enter into such a competition: and while the company may accidentally obtain able service from some man who is competent but otherwise "down on his luck," the probabilities are strongly against such an event; and even then they will be most likely to get the full measure of the accepted fee—but no more—whatever the conditions may demand. Though the advice may be to the disadvantage of our advertising columns, we would earnestly suggest to the ruling spirits of new railroads, east, west, north and south, that a first-class, competent engineer is really worth more money to the future success of their enterprise than the most extravagant salary paid, even by the corporations that thoroughly appreciate this fact. The true value of the position of a true engineer can not be estimated in dollars, and you can never buy one at an auction.

Government Publications and How to Get Them.

The receipt in this office of the last priced list of Parliamentary Papers, as issued by EYRE & SPOTTISWOODE, of London, suggests the desirability of some similar system of disposal of official documents in our own country.

The firm referred to have obtained, in a public competition, the right to act as sole agents in England and Wales for the sale of official publications, either singly or in sets, and at prices affixed that seem to cover very little more than their actual cost. Two other firms control their sale in Scotland and Ireland on similar conditions.

Aside from the great point of making such publications accessible to every one, as they should be, is the further very useful feature of publishing in monthly bulletins lists of *all* papers printed. A price is affixed in each case, and these prices range from ½*d*, or 1 cent, to 5 or 6 shillings, as their bulk may warrant. Two sets of prices give their value with and without postage, so that anyone can either buy direct or send for what he wants. The selling firms also offer their services in tracing old papers, of any date, and upon receipt of address, will send their monthly lists to any intending purchaser, post free.

There could hardly exist a stronger contrast than that between the English system just described and our own utter lack of system or good sense in the distribution of public documents. In the first place, outside of Washington itself, there is no accessible list of what is published by our Government, and we doubt somewhat if even in our capital you could find a full list up to date. No matter how valuable in itself, or how useful the contained information might be to some seeker after knowledge, the public remains ignorant of the vast bulk of the publications its money pays for. It is by accident or by favor of a Congressman only that the, perhaps, long sought data comes to light. And it is a notorious saying, shameful in its truthfulness, that the best place to find our Government publications is in some one of the many junk-shops and second-hand book-stores of Washington.

There is no particular objection to giving to each Congressman a sufficient batch of "Pub. Doc's" to place where he feels they will do him personally the most good with his constituents, even if these constituents can't read them when received; they do their intended work all the same. But we do object most strongly to making every man who has an honest professional or commercial interest in the contents of these documents subservient to the whims or personal favor of a Member of Congress for a presentation copy. Interested parties would gladly pay the cost of production, and a small profit if deemed expedient, if they only first knew what was published and then could simply buy from some designated office what they wanted. The U. S. Patent Office, the Geological Survey and some other departments now sell their drawings, maps, reports, etc., and why not extend the system to every publication?

But first of all let us have a monthly list of public documents of all kinds issued by our Government. The cost of so doing would add comparatively little to our administrative expenses, and its value would be very great. Let these lists be regularly sent to each public library of any standing in the country; and if they are not at once put on sale, there would be a better chance than now of these documents getting into channels where they would really do some good, even if our Congressmen did have to stand some additional and more persistent boring from others than the country tavern-keeper or local politician. The Congressman's clerk might find his perquisites from old junk cut down at the end of a session, but someone else would receive compensating benefit.

But better still, publish the bulletin and sell the documents; either directly from some governmental department organized for the purpose, or by contract to private parties, as after the English method. There is two much consideration for a few political leaders, and too little for the great public in our present practice, and it is about time that we realized that we have grown considerably since this practice was inaugurated.

Blasting Without Tamping.

The experiments of Prof. MUNROE upon detonating gun-cotton, elsewhere noted, are not only of exceeding interest in the peculiar effects observed but are also valuable as furnishing some further data upon the peculiarities of high explosives, and as having a definite bearing upon the results of blasting without tamping referred to in a late issue.

In theorizing upon the cause of the unexpected character of the reproduction of letters, etc., originally impressed upon the base of the gun-cotton cylinder, it seems that the most probable cause is that chargeable to the projectile energy of the gases of explosion. In the case of sunken characters in the gun-cotton, the range is greater, and while for the portions of the base in direct contact with the plate the energy simply acts as a direct pres-

sure in forming a saucer-like depression in the plate, the parts covered by the sunken characters in the gun-cotton permit this energy to act with the effect of a blow, and as a result causes a depression conforming in outline with the air-spaces represented by the sunken characters. The fact that filling the depressions in the cylinder with vaseline entirely neutralizes the reproducing effect, bears this out; for vaseline, like water, is practically incompressible, and its presence reduces the entire base of the gun-cotton cylinder to a plane surface in direct contact with the iron plate, and the explosive result is simply a powerful but direct pressure and not a blow.

The experiments with the wire gauze and the green leaves come under the same theory of cause. In both cases we have the air-spaces increasing the range of the projectile force of the gases, and the points in contact transmitting pressure only. In the case of a secondary plate containing the characters, we have pressure only to deal with, and the result is what would be expected under these circumstances, a figure in relief from the sunken die.

Of course in assuming the above theory to be correct we must consider the explosive as being in direct contact with the plate, and duly appreciate the enormous kinetic energy stored up in gun-cotton, and the infinite rapidity of its action. In short, the basis of the theory is just the difference between a dead weight or pressure, and this same weight falling through a space, small in this case, but greatly augmented in effect by what represents a very great weight falling with almost unmeasurable velocity.

In discussing the rending effect of an explosive upon the sides of a drill-hole and the character and positions of the tamping in that hole, it seems to us that this air-space and the resulting difference between dead pressure and increased range of blow must have an effect worthy of more study than is now given it. We were not aware of Prof. MUNROE's experiments when writing our last editorial, and there implied that the air-space would probably be more effective with slow-burning black powder than with high explosives. And as far as the better opportunity for the diffusion of the gases of explosion and the perfect combustion of every grain of powder are concerned, we still believe that this air-space is relatively more essential to the development of the full power of gunpowder than it is in the case of the high explosives. If this air-space were used in connection with the latter it would at first seem that we were only increasing the range of the blow in the direction of the bore-hole and thus augmenting an objectionable projectile effect.

But there are other elements to be considered, and the chief of these seems to be the value of the air-space in not only permitting a perfect combustion of the explosive material and the thorough loosening of the gases of explosion, but also in providing the requisite space to put this gas in motion towards the mouth of the hole. Then when near the end of its path this gas, just at its maximum power and velocity, is suddenly and for only an instant of time checked by the tamping, which should form a hermetical seal, and the full power of the gas is suddenly converted into a blow upon the sides of the hole and a bursting effect follows. This is the theory of the rending of a gun barrel by the same charge of powder and the same projectile, that would be perfectly safe were there no air-space between the charge and the ball. The ball may fit no tighter halfway down than it would if it were rammed to the bottom of the barrel, but in one case it is started gently by the first atom of gas developed, and is impelled forward with an increasing velocity due to the gathering development of the gases; in the other case the projectile at rest is suddenly struck by the full power of the gas, developed in passing through the air-space, and even the relatively slight inertia of the ball is sufficient to check the forward rush of gas and convert it into a lateral blow acting upon the confining cylinder, and bursting usually follows.

This theory seems reasonable, and is so easily tested in the case of mining operations that it fully warrants an exhaustive trial, with high explosives as well as gun powder, in the light shed upon this subject by the experiments of Prof. MUNROE.

CORRESPONDENCE.

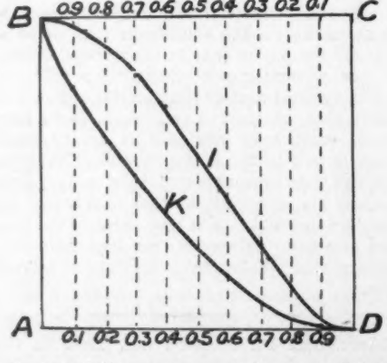
Continuous Girders.

DEFIANCE, O., Oct. 9, 1887.

EDITOR ENGINEERING NEWS:

Permit me again to call attention to the simplification of the problem of calculating continuous girders that is possible by the use of the curve mentioned in my article of May 7. It, in fact, permits of a "cut and try" method, and does not require a knowledge of the theory of "area moments," "fixed verticals," "transversals," etc., and depends simply on the known

Fig. 1



facts that all the maximum strains can be deduced from the case where one segment of the span is completely loaded, while the other is wholly unloaded.

Let M be the moment at the pier.

S, the shear at the left end of the span.

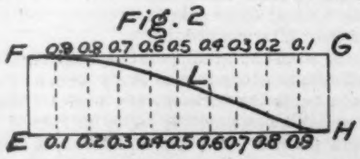
S', the shear at the right end of the span.

Then these quantities may be expressed by the three following equations.

$$M = A\,a + B\,b + C_1.$$
$$S = A'\,a + B'\,b + R\,L + C_2.$$
$$S' = A''\,a + B''\,b + R'\,\rho + C_3$$

in which A, A', A'', B, B', B'' R, R', C_1, C_2 and C_3 are known quantities and a, b, L and ρ are positive

Fig. 2



quantities whose least value is 0 and whose greatest is unity. The easiest method to put them in this form is by Prof. MERRIMAN'S system of indeterminate multipliers. As here given these latter quantities are applicable to a uniform load only, but the neglected half-panel weight affects the shear mostly and has small influence on the pier moments for any ordinary number of panels.

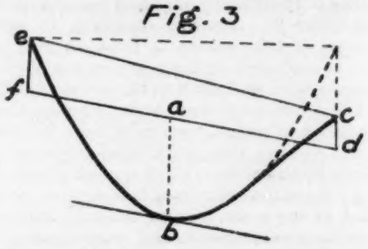
The quantities a and b are defined by

$$a = 4 \int (2k - 3k^2 + k^3)\,dk$$
$$b = 4 \int (k - k^3)\,dk$$

in which k is the ratio of the distance of the indefinitely small weight from the left support to the length of the span. Let v be the ratio of the unloaded segment to the length of span. Then taking the integral to include the whole load for the *left segment loaded* $a = (1 - v^2)^2$ and is the vertical ordinate in Fig. 1, taken between AD and the curve BID, v being positive to the right. In this figure the parallel sides = unity. On the other hand $b = (1 - v)^2\,(1 + 2\,v - v^2)$ and is the vertical ordinate (same Fig.) between BC and this curve, v being positive to the left.

For the *right segment loaded these values change places.* By constructing this curve to a scale of

Fig. 3



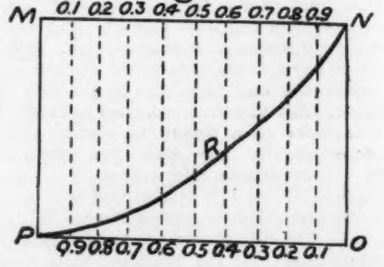
5-ins. = unity these values may be found correct nearly to the third decimal.

The definition of L and ρ is

$$L = 2 \int^{v} (1 - k)\,dk$$
$$\rho = 2 \int k\,dk$$

the integrals also to include the whole load and are coefficients to obtain the reactions of a single girder. The value wanted is usually $(1 - v)^2$ which is the vertical ordinate between A and the curve $B\,K\,D$

Fig. 4.



and is for the unloaded end. For the loaded end take the ordinate between $B\,C$ and this curve if it is wanted. Its value is $(1 - v^2)$. It is seldom needed.

The quickest way is to construct the curves of pier moment ordinates and shearing stress from these curves, but it is necessary to construct but one curve to show the facts due to both right and left segment loaded as the curves are (we might call it) complimentary. This is shown in the curve of pier ordinates, but one would not expect that the curve $P\,R\,N$ in Fig. 4 would show by its lower ordinates the shear due to left segment loaded and at the same time by its upper ordinates that due to right segment loaded, but such is the case.

For convenience in setting out the curve $B\,I\,D$, I give ordinates sufficient to draw it:

For $v = 0.1$	ordinate = 0.9801	for $v = 0.5$	ordinate = 0.5625		
$v = 0.2$	" = 0.9216	$v = 0.6$	" = 0.4096		
$v = 0.3$	" = 0.8281	$v = 0.7$	" = 0.2601		
$v = 0.4$	" = 0.7056	$v = 0.8$	" = 0.1296		
		$v = 0.9$	" = 0.0361		

A is taken as an origin.

Yours respectfully, C. H. LINDENBERGER.

More Sealed Proposals for Engineering Work.

ENTERPRISE, Fla., Oct. 12, 1887.

EDITOR ENGINEERING NEWS:

Your Montgomery correspondent and the remarkable advertisement he encloses, leads me to report to you that the fool-killer is also neglecting his duties in Florida. Here matters have progressed further, and construction is being pushed on a line located by contract. The proposed line is 500 miles long, and the first 100 have been located in this manner. Moreover, the location seems to be all the engineering required. The contractor was furnished a memorandum of center cuttings, but does his own side-staking, and I suppose accepts the work and makes his own estimates as well. Can spigot economy and bung-hole waste devise anything to beat this? There are still 400 miles to locate, which I presume will go in the same way. I regret that both these examples of idiocy should come from the South, though in this Florida case the capital and alleged brains at the head of the concern are furnished by Northern men. K.

The Nantucket Jetty.

ST. LOUIS, Oct. 13, 1887.

EDITOR ENGINEERING NEWS:

Referring to the reply made by Prof. HAUPT to my comments on the Nantucket Harbor Improvement, as published in your issue of Aug. 27, will you permit me to say that the submerged portion of the Eastern jetty is, in round numbers, about 4,800 ft. long instead of 500 ft. Very respectfully,

N. W. EAYRS.

On Dimensioning.

CHARLESTON, S. C. Oct. 15, 1887.

EDITOR ENGINEERING NEWS:

Mr. A. D. OTTEWELL quotes me in your issue of Oct. 8th, to the effect that my formula (1) is "intended solely for the chords and ties of a bridge." I, of course, had framed bridges in mind only, in penning that sentence, as the argument at the time concerned hangers which are used on framed bridges only. I desire to add that the same course of measuring by which (1) was deduced, applies equally to the unit stress for the flanges of web plate girders, so that formula (1) is intended to be universally applicable accept as to hangers. For suspenders, a little less unit stress than the formula gives might be preferred by some, but how much less it is impossible to say, and it is therefore hardly necessary to make suspenders an exception as the difference must be very small in any case.

Respectfully, WM. CAIN.

The Streets of Washington, D. C., in 1886-87.

Capt. EUGENE GRIFFIN, U. S. Engs., in charge of the streets and highways of Washington, D. C., has just made his annual report to the Engineer Commissioner, Col. WM. H. LUDLOW, and from it we make the following abstract;

The report covers the operations for the fiscal year ending June 30, 1887. The following summary shows the condition of the streets on July 1 last:

Description.	Sq. Yds.	Mls.	Per Ct.
Sheet asphalt	751 116	31·8	14·55
Coal tar, distillate and asphalt.	782,461	33·4	15·16
Asphalt block	95.8·9	4·4	1·84
Stone block (granite or trap)	534.718	21·5	10·35
Rough stone (cobble or rubble.)	490,546	12·7	9·50
Macadam	223.009	8·2	4·35
Gravel	725.998	36·7	14·06
Wood	18,403	0·7	0·35
Unimproved	1,539,650	84·1	29·84
Total	5,163,190	233·5	100·00

Under the appropriation of $266 000 for the replacement of pavements and work on sundry streets, 116,011.69 sq. yds. of streets were paved or improved at a total cost of $265,574.71. The work done is recapitulated as follows:

Georgetown	$8,516.45	3.2 per cent.
Northwest	146 241.20	55.1 per cent.
Southwest	35,538.63	13.4 per cent.
Southeast	16,009.81	6.0 per cent.
Northeast	59.268.62	22.3 per cent.
Material unexpended	425.29	
Total	$26 ',000.00	

The last item is for granite blocks, curb, and other material purchased, but unexpended. On June 30, 1887, there were 43,100 granite blocks on hand, which, at $45 per 1,000, were valued at $1,939.50. The cost of inspection is less than 2 per cent. of the total expenditure.

The following table gives the total square yards of streets and avenues within the city limits which have yet to be improved:

As the wooden pavements of 1878-9 deteriorated, some of them were covered with gravel instead of being replaced with other pavement, and in the annual report of 1880 they figured as gravelled streets. These should now, like the bulk of the streets, be repaved with sheet or block asphalte, coal-tar distillate or granite blocks.

In referring to the use of coal-tar distillate for pavements, the report says:—

It will be noticed that of the new pavements laid in 1886-7 27 per cent were sheet asphalt, 2 p r cent granite block, 25 per cent asphalt block, and 46 per cent sheet coal-tar distillate. As this is the first year, since the organization of the present form of District government, that coal-tar distillate pavements have been laid in the str.ets of Washington, a few words in this connection will not be inappropriate. Previous to 1878 745,305 sq. yds. of coal-tar pavements of various kinds were laid at prices ranging from $1.74 to $3.70 per sq. yd. Many of these pavements proved unreliable, either through inherent defects in the materials used or faulty methods of mixing and laying. Some went to pieces in a few years and others deteriorated so rapidly as to soon place the annual cost of maintenance at excessively high figures. Of the so-called Evans pavement 190,663 sq. yds. were laid mostly in 1873. When only 2 years old nearly all these pavements were resurfaced at an average cost of $1.09 per sq. yd. As late as 1877, Lieut. HOXIE estimated 20 cts. per yd. per annum as the cost of maintaining coal-tar pavements. The fault was believed to lie in the material itself, and the first board of Commissioners appointed under the act of June 11, 1878, expressed their objections to these pavements as follows:

"In determining the class of pavements to be hereafter laid the Commissioners * * * * maintain that each class of pavement must prove its qualities under the test of actual traffic before being extensively laid upon the streets of this city.

"While some of the latter and better class of coal-tar pavements show good surfaces and give fair promise of a reasonable durability, yet the general condition of this class of pavement in the city is such as to lead to their condemnation as faulty in principle and deficient in vitality. The use of bituminous bases has also given rise to many perplexing problems in the grades of streets upon which they have been used, and as, when properly laid, their cost is as great, if not greater, than the hydraulic concrete, they have been definitely abandoned."

The conclusion then reached has been consistently adhered to up to the past year. Asphalt surface on an hydraulic cement concrete base became the standard smooth pavement of Washington. The defect believed to be inherent in all paving compounds into which coal tar enters as an ingredient was thus stated in the report of the board of experts made to the mayor of Philadelphia in July, 1884: "The coal-tar pavement is not recommended by us for the reason that the cementing substance is a product of gas-tar, obtained by interrupting the destructive distillation of that compound after it has reached a certain point. When placed on the street and subjected to atmospheric influence, a slow and gradual oxidation takes place, by which the tar loses its cementing qualities and becomes inert. The particles of sand then lose their cohesion, and the pavement rapidly disintegrates."

Wherever laid in the United States coal-tar pavements have, as a rule, given little satisfaction, and the first board of Commissioners simply gave voice to public opinion in discarding them. In the meantime, however, a period of 9 years has elapsed, and the well-preserved condition of "some of the later and better class of coal-tar pavements" have led many to believe that the faults of the earlier pavements are not irremediable and that, with the experience gained and with proper care, such pavements can be laid nearly equal to the asphalt in most respects and superior in the quality of economy of the first cost, as well as in some other minor particulars. The cost of maintenance is a very important element to consider in determining the value of a pavement. From the office records I have had prepared a table showing the original cost and yearly expense for maintenance, including resurfacing of each pavement laid since 1871.

From the table it appears that the average annual expenditure for maintenance of the coal-tar pavements, for the 15 years ending July 1, 1886, has been 7 2-10 cts. per sq. yd. Of the Evans pavements, 117,324 sq. yds. were resurfaced by Scharf within 2 years after laying, and virtually became Scharf pavements. Considering them as such, the second total is obtained as given in the table, with a mean average *annual* expenditure for maintenance of 5½ cts. per sq. yd. For the first 5 years the annual average is 3 7-10 cts.; for the second 5 years, 6 cts.; for the last 5 years, 6 6-10 cts. That a durable coal-tar pavement can be laid is proven by the fact that the 158,595 sq. yds. of vulcanite pavements have only averaged 2 9-10 cts. per sq. yd. per annum for 14 years maintenance, the average being 3-10 cts. per yd. for the first 5 years, 4 2-10 cts. for the second 5 years, and 4 cts. for the last 4 years. Had all of these pavements been resurfaced during the past year at the contract price of $1.05 per sq. yd., they would be under guarantee for 5 years from July 1, 1887, and the mean average annual expense to the District for maintenance for a period of 20 years would not exceed 7¼ cts. per sq. yd. Trinidad and Neufchatel Rock Asphalt pavements were laid on Pennsylvania avenue and F street previous to 1878. The following table shows the comparative cost of maintenance of the asphalt and coal-tar pavements.

STREETS AND AVENUES TO BE IMPROVED (JULY 1, 1887).

Present condition.	Georgetown.	Northwest.	Southwest.	Southeast.	Northeast.	Total.
	sq. yds.	sq. yds.	sq. yds.	sq. yds.	sq. yds.	sq. yds.
Unimproved	78,491	355,509	209,304	372,878	392,868	1,539,050
Gravel	30,972	208,684	62,679	121,330	302,334	725,999
Macadam	2,810	125,397	19,800	71,352	5,560	225,009
Cobble	28,073	117,410	81,118	34,733	17,569	271,903
Wood		7,000		11,403		18,403
Total	140,346	814,000	375,901	731,696	718,331	2,780,364

NOTE.—This table includes the streets and avenues in schedules for 1887-8, now under contract, amounting to 105,000 sq. yds. (cost $300,000). The improvement of these streets with standard roadway pavement, curb, sidewalk, etc., at an average cost of $2.75 per sq. yd., will require an expenditure of $7,646,001.

COMPARATIVE COST OF MAINTENANCE OF COAL-TAR AND ASPHALT PAVEMENTS.

Coal-Tar Distillate.

Class of Pavements.	No. of sq. yds.	Av. cost of maintenance per sq. yd. per ann. for 9 yrs.	for 10 yrs.
All including—			
Vulcanite	715,303	$0.086	$0.079
Vulcanite	158,595	0.026	0.025
Asphalt.			
Neufchatel Rock	31,689	0.015	0.016
Grahamite	55,112	0.020	.....

From this table it will be seen that as the record stands now, even the vulcanite pavement is somewhat more expensive to maintain than the asphalt pavements.

The report in further discussing the use of coal-tar distillates, notes the trouble in maintaining street grades where the three courses of base, binder and wearing surfaces form a solid mass 6 ins. thick. The surface wear is never quite uniform, and in attempting to resurface, it is impracticable to strip a coal-tar surface as in the case of an asphalt pavement with a concrete base. The practice is to cut out what may be necessary near the nearly unworn curb portions and put a new surface on the roadway as it stands. The result is to raise the roadway at every resurfacing; but as each resurfacing should not raise the crown more than ½ in. and this should not occur oftener than once in 15 years, the total upword growth for a century should not exceed 3½ ins. The little cohesion between an asphalt surface and a concrete base, while it has advantages in repairs, and is easily stripped, has some disadvantages in reducing the longitudinal strength and permits a certain pulling or stretching under traffic which shows in objectionable waves on the surface. Capt. GRIFFIN thinks this may be caused in part by the depth of the asphalte mixture (2½ ins.) As far as Capt. GRIFFIN's observation extends, the distillate pavements are less subject to these waves and weather cracks than asphalte pavement. He says that climate has much to do with the durability of a pavement, and Washington pavements suffer more in the three months of winter than in the other nine months of the year.

The return to the distillate pavement was virtually forced upon the Commissioners by the clause in the appropriation Act of 1886-87, which "provided also, under this appropriation, no contract shall be made for making or repairing concrete or asphalte pavement at a higher price than $2 per sq. yd. for a quality equal to the best heretofore laid in the district." Under these and other restrictions of the Act no bids were received in answer to advertisements for asphalte pavements. The law virtually prohibits this latter class of pavement under existing conditions.

Capt. GRIFFIN discusses at considerable length the comparative defects and merits of different pavements. He concludes that distillate pavements, constructed of carefully selected and combined material and properly laid, will cost no more than the asphalt for maintenance.

The defects of weather cracks and wave surfaces in asphalt pavements could probably be remedied to a certain extent by reducing the thickness of the wearing surface to 2 ins. or even 1½ ins., and interposing a 2 in. layer of binder between the surface

and the base. The latter could then be reduced to 5 ins. or less.

At present prices the cost of such a pavement would be per square yard:

5-inch hydraulic base	$0.694
2-inch binder (1½ when compacted)	.394
2-inch wearing surface (compacted)	1.176
	$2,264

These items are based on the current prices for repairs to concrete pavements. The pavement could be laid in quantity at a less price than the standard asphalt. It is of the same thickness, 8½ ins. Asphalt blocks do not make a suitable pavement for narrow, well-traveled streets, for the general surface of streets containing railway tracks or for streets of heavy traffic. Whenever laid on such streets they have heretofore failed to show the requisite endurance. They are only recommended for residence streets and streets and alleys of light traffic. In such locations they make an excellent pavement; smooth, durable, noiseless, clean, healthy and pleasing in appearance.

The cedar-block pavements used so extensively throughout the northwest are cheap ($1 to $1.30 per sq. yd.), but deteriorate rapidly, are objectionable on sanitary grounds, and are anything but smooth after a brief wear. Creosoted wooden blocks on a hydraulic cement foundation, when newly laid, approach nearer the ideal block pavement than any other form.

The record of brick pavements is an irregular one. A bid was submitted in April last for laying brick pavements at $1.87 per square yard, 11 cents per yard cheaper than the distillate, but the saving of 11 cents per yard was not deemed a sufficient inducement to warrant the contracting for such pavements in the absence of any test of their durability on the streets of Washington.

During the year 48,819 sq. yds. of sidewalk were laid in connection with street paving and other walks laid out of appropriation for current repairs; the aggregate was 86,939 sq. yds., divided as follows: Asphalte tile, 7,064; asphalte block, 1,365; mastic, 3,056, and brick, 75,444 sq. yds. Of the two classes of block and sheet asphalte sidewalk the first has the advantage of being laid without special plant, and can be removed and easily replaced for trench cutting, etc., but the sheet asphalte is more impervious to water and is more homogeneous and smoother under foot, as a rule. Bids were received last year for sheet asphalte sidewalks at $1.47 per sq. yd. The coal tar walks are reported as being "an unmitigated nuisance." Capt. GRIFFIN approves of an artificial stone sidewalk in hexagonal blocks laid on concrete, and used in St. Paul. The blocks are 2 ins. thick and 18 ins. across, and are moulded by machinery, under pressure, in Portland cement and sand in proportions of 1 to 3 or 5, with 1 to 1 on the surface. These blocks are durable and handsome, and cost 18 cts. per sq. ft., or $1.62 per sq. yd.

In the year 42,297 lin. ft. of curb were set or reset. Two experiments have been tried in this line; one is a combination curb and gutter of concrete with granolithic facing, and an interior recess for underground wires. The other was a granite curb, 8 ins. square, set in a concrete bed. The advantages of both lie in their broad base, which prevents the settlement usual to the 5×20 in. stone curb.

In reference to permit work, Capt. GRIFFIN says that a wholesome rivalry exists between foremen as to which can do the cheapest work. And as the property-owner pays for the labor, this is a good thing for the owner. The general result of this system has been good.

The street-sweeping contract was let to Mr. I. S. FILBERT for 25½ cts. per 1,000 sq. yds. Many complaints were made of imperfect work, and the aggregate deducted for imperfect work amounted to $1,662.70, or the contractor did this amount of work without payment because it was not in accordance with the contract. The total appropriation for sweeping, cleaning and sprinkling highways and alleys, for the fiscal year, was $58,000. The trouble is that Congress does not set aside money enough to do this work properly. A few of the principal streets are swept nightly, others only three times a week, a great majority only once a week, and many others only once in two weeks. For 1888-89, $65,100 is asked for street sweeping, $12,000 for cleaning alleys, and $8,000 for cleaning unpaved streets. $27,423 were expended in opening and extending suburban streets.

PERSONAL.

Mr. E. G. MERRILL, of Boston, a civil engineer, formerly in the employ of the Union Pacific R. R., died at Omaha, Neb., Oct. 13, at the age of 30.

Mr. J. W. SHERWOOD has resigned the Superintendency of the Cincinnati, Indianapolis, St. Louis & Chicago Railroad. It is reported that his successor will be Mr. GEO. BENDER, now Superintendent of the Indianapolis, Decatur & Springfield.

T. M. JACKSON, C. E., of Clarksburg, W. Va., has been appointed by the council of that city as engineer to approve plans and specifications, let contracts, etc., for the construction of the new water-works, which will be commenced as soon as the drawings can be prepared.

Mr. J. M. WILLARD, City Engineer of Pasadena, Cal., has been appointed Chief Engineer of the San Pedro, Los Angeles & Utah Railway Co. The estimated length of the road is 275 miles, of which 60 miles have been located and 10 miles built.

A meeting of the engineers, architects and surveyors of Arkansas, will be held at Little Rock, Ark., Nov. 9, for the purpose of organizing a society. A good attendance is promised and an interesting programme already prepared. For further particulars address Prof. J. M. WHITHAM, Arkansas Industrical University, Fayetteville, N. C.

Major W. H. HEUER, U. S. Engineer Corps, in charge of the construction department of the 8th Lighthouse District and of the rivers not under the charge of the Mississippi River Commission, with office at New Orleans, La., will on Nov. 1 be relieved by Capt. WALTER H. FISK, now on duty in the office of the Chief Engineer at Washington. Major HEUER will proceed to the Pacific coast and will have his headquarters at San Francisco, Cal.: he has been in charge of the office at New Orleans for 7 years and the change is made at his own request.

SOCIETY PROCEEDINGS.

American Society of Civil Engineers.—Meeting of Oct. 19, Col. WM. H. PAINE, presiding. The first paper, read by the Secretary, was "On Brick Making in Sinaloa, Mexico," by SENOR DON JUAN SOSA Y AVELA, of Culiacan. The writer briefly described the process of making *adobe* or sun dried bricks and burned bricks for house building, tiling, etc., with their dimensions and prices. In this connection, Mr. J. FOSTER FLAGG mentioned that in Peru the sun dried bricks seemed to improve in quality with age, and when walls, 300 years old, were torn down in Lima the old material sold for more money than new bricks of the same character could be bought for. Secretary BOGART then read several papers upon the results of "Experiments as to the Influence of Fineness of Sand upon Cement Mortars." The first was by Mr. EMIL KUICHLING, and gave the result of tests made for the Rochester, New York, Board of Public Works by the Engineering Department of Cornell University. Comparative tests were made with standard quartz sand and the local sands of Rochester, used with Akron, Star and Buffalo brands of cements. These tests were given in detail, and the general conclusion confirmed the opinion of previous experimenters, that other things being equal the coarser sand gave the best results.

The next paper was by Mr. E. B. NOYES, and gave notes upon the rather peculiar behavior of Bangs & Dana cement, and other brands from the natural cement quarries in the neighborhood of Syracuse, N. Y. Mr. NOYES has been testing these cements for the State Board of Public Works, and gave his results in detail and by diagrams. The peculiarities noted are that the cement is exceedingly coarse as delivered, and that the neat cement tests invariably fell below the combined cement and sand tests for any age of cement. These notes brought out considerable discussion upon the effect of coarse and fine sand upon cements and that of coarse particles in the cement itself. Mr. PARSONS advanced a theory that the usual high tensile strength of cement mixed with standard quartz sand as compared with the neat cement test, in ordinary brands, might be due to the roughness of the sand particle and their interlocking in the mass. The effect of such sand in a tensile test was either a break across the sand particles, which are usually stronger than the cement itself, or a break around the sand particles and thus virtually present a greater area of fracture than that assumed. The neat cement not having any obstructing particles of this nature would break in a straight line across the briquette and show a lower breaking weight comparatively. This discussion was participated in by Messrs. TOMPKINS, PAINE, EMERY and others, and the general expression of opinion seemed to confirm the general theory advanced by Mr. PARSONS.

Mr. P. C. ASSERSON, Civil Engineer of the Brooklyn Navy Yard, made some remarks on the quality of cement mortar removed by him from the dry-dock wall. This mortar had been in place about 40 years, but was still soft and easily scraped out of the joints. The specimens exhibited by Mr. ASSERSON seemed to show the presence of some free lime in the original mortar. He was not able to state where the hydraulic cement came from that was used, and he also noted the unusually difficult conditions of laying this masonry owing to the powerful springs of water met with.

Engineers Club of Philadelphia.—Regular meeting of October 1st, 1887. Past-President WASHINGTON JONES in the chair; 30 members and 4 visitors present. Mr. J. M. CAMERON, introduced by Mr. HENRY G. MORRIS, described the Carnell Air Injector.

This machine is intended to supply air to the furnaces of steam boilers of all classes. Steam is taken from top of boiler and carried through the combustion chamber, where it is heated to about 900° Fahr., then to a distributing apparatus discharging under the grate. The steam, heated to the condition of a gas, takes with it the necessary air for combustion. It is claimed that the heat to which the steam is raised, in connection with a reduction of pressure to 20 lbs. per sq. in., increases the relative volume to 1,800, which would be eight times more effective than saturated steam. The heat taken from combustion chamber is given out to the air entering the furnace. Tests are said to have shown an increased boiler power of 28 to 100 per cent., with a proportional saving in fuel of 2 per cent. above that obtained by natural draft. Mr. HENRY G. MORRIS exhibited and described a working model of a traveler to carry wires, ropes, etc., through conduits, which he had devised. The apparatus consists of two parts, one placed ahead of the other, and each provided with spring claws which will slide ahead in the conduit, but will take hold of the sides and prevent any backward motion. The parts are operated by two cords working on a system of pulleys, so that, by the alternate pulling of the cords, the whole apparatus will move ahead of the operator through the conduit. That is to say, pulling one cord will drag the rear piece up to the front piece, and pulling the other cord will send the front piece a distance ahead, each part, with the attached pulleys, holding firmly to the sides while the other part is being moved.

Prof. L. M. HAUPT made some remarks upon his experiments with Current Deflectors at Five-Mile Bar, and showed how urgently the city and river interests required a channel across it. He then suggested a plan whereby he proposed to create a channel, sufficient to meet the demands of commerce, upon the following principles: 1. If the *bottom velocity* of a stream be increased to the limit required by the character of the material forming its bed, it will scour; if diminished, it will deposit. 2. If the *momentum* of a stream be suddenly arrested by an obstruction placed in its path, a reaction will be produced, its head will be increased, and the bottom will be scoured out. 3. If the *volume* of a stream be partially deflected by a trailing wall, from one side of a cross-over bar to the opposite side, the current over the bar will be quickened, and the crest lowered, above the line of the works. 4. If the *form* of cross-section of a stream be modified by cutting at one point and filling at another point of the same section so that the area is not changed, other things being equal, the discharge will not be materially affected, and the part so deepened will remain open. 5. If a stream be compressed laterally into a smaller section, its velocity head near the banks will be increased, while that at the center will be diminished, and consequently the channel will be bifurcated and the deepest water be found near shore. If, by the application of these laws of flowing water, a channel, sufficiently wide and deep for navigation, be cut across a bar, it will be self-sustaining and cost much less than if the entire bar were disturbed by the usual lateral dikes or by dredging.

The Secretary announced the death, since the summer adjournment, of Mr. FRANK MADDOCK, Active Member of the Club.—HOWARD MURPHY, *Sec. and Treas.*

Liverpool Engineering Society.—At the usual meeting at the Royal Institution, Colquitt street, on Wednesday, Oct. 5; Mr. JOHN J. WEBSTER, M. Inst. C. E., president in the chair. A paper was read by Mr. F. HUDDLESTON, M. Inst. C. E., on the "Coaling Appliances of the Port of Liverpool." The coal annually shipped at Liverpool, Birkenhead and Garston is rather more than 3,000,000 tons, from 500,000 to 650,000 tons is exported to foreign parts, most of the rest being used as bunker coal. The Liverpool High Level Coal railway at the Wellington and Bramley Moore docks was opened for use in 1856, and in 1881 the accommodation was doubled. The appliances consist of nine hydraulic cranes, with powers varying from 10½ to 24 tons used to load vessels of all classes and one balance tip for loading flats. The traffic at the present time is carried on by means of locomotives and hydraulic capstans, but up to the year 1864, horses only were used. The level of the railway is about 21 ft. above the quay, the space beneath it being made use of as sheds, etc., and

there is no interference with the ordinary traffic to and from the docks. The coal shipped is from the north-west and south-west coal fields of Lancashire, and is brought down by the Lancashire & Yorkshire Railway Co., who provide extensive sidings at Sandhills. The Birkenhead appliances consist of three hydraulic hoists and seven low level balance tips in the east and west floats. The hoists are used for vessels of large size, while the balance tips put bunker coal into flats, which are afterwards taken alongside the steamships in the various docks, about 200,000 tons of South Wales coal is shipped yearly at Birkenhead for bunker use. The shunting at the tips is done by horses. The sidings for coal wagons are at the Cavendish wharf, Liverpool and Birkenhead together ship 2,000,000 tons per annum. At the North Western Railway Co.'s docks at Garston, there are eight vertical drop balance tips worked from a high level and fed by hydraulic capstans. These ship annually rather over 1,000,000 tons of coal from south-west Lancashire, the greater part of which probably goes coastwise.

New England Roadmasters' Association.—The fifth annual convention of the Association met at Hartford, Conn., on Wednesday, Oct. 19, with about 20 members in attendance. The reports of the officers showed the Association to be in a prosperous condition. The following were elected officers for the ensuing year:

President, J. S. Lane (N. Y., N. H. & H. R. R.).
Vice-President, J. R. Patch (Conn. River R. R.).
Chaplain, E. W. Horner (C.Vt. R. R.).
Secretary, W. F. Ellis (Prov. & Worcester R. R.).
Treasurer, Geo. Nevens, (Me. Cen. R. R.).
Executive Committee: L. H. Perkins, (N. Y. N. H. & H. R. R.); P. A. Eaton, (Concord R. R.); G. W. Bishop, (N. Y. & N. E. R. R.).

It was voted to hold the next annual meeting at Boston on the third Wednesday of August, 1888. In our next issue we will give some account of the technical proceedings of the convention.

Society of Railroad Water Supply Superintendents.—This Society held a meeting at Marion, Iowa, Oct. 13. The chief business transacted was as follows:

It was decided by motion that each member should work up the extension of membership by ascertaining the names of all parties in their vicinity having charge of railroad water supply, and report same to the Secretary. The need of a stamp or seal was conceded, but the choice of design was deferred until next meeting. The question of a test word or badge was not acted upon. A uniform letter to be used by members was decided to be necessary, but this was also deferred until next meeting, and the collection of interesting information was left with the members with the understanding that all such should be forwarded to the Secretary.

The subjects for discussion at the next meeting in May will be: 1. The best mode of filtering muddy water and the most practical manner of counteracting the acids found in water of the coal districts to make it suitable for boiler purposes. 2. Wells, with complete statistics.

Roadmasters' Convention.—The fifth annual meeting of this association opened at Cleveland, O. on Oct. 11, with an address by Mr. CHARLES LATIMER, who said that there were nearly 2,000 roadmasters in this country, and referred at length to the great responsibility of their position, and the nature of their duties. Over 100 members were present at the Convention, and the committee reports included the subjects of guard-rails, standard rails and frogs, standard track, etc. The committee on standard rails recommend a weight of from 60 to 100 lbs. to meet the great increase in loads carried. In the matter of frogs, a report was adopted advocating the use of spring frogs on main track and rigid frogs on side track. The committee on bridge guard-rails recommended the use of the LATIMER re-railing device with an amendment that the guard-rail run the entire length of the bridge. The committee on standard track recommended the "double angle bar joint." The next meeting will be held in Washington, D. C. on Sept. 11, 1888. The following officers were elected for the ensuing year: *President*, J. W. Craig, Charleston & Savannah Railroad, Charleston, S. C. *First Vice President*, J. Burnett, Joliet Steel Works, Joliet, Ill. *Second VicePresident*, James Sloan, C. & E. I. R.R., Danville, Ill. *Secretary and Treasurer*, H. W. Reed S. F. and W. Railway, Way Cross, Ga. *Members of the Executive Committee.*—C. H. Cornell, C. M. & St. Paul Railroad, Dubuque, Ia., and Richard Caffrey, Lehigh Valley Railroad, White Haven, Pa.

PUBLICATIONS RECEIVED.

N. W. Ayer & Son's American Newspaper Annual, containing a catalogue of American newspapers, etc. etc Philadelphia, N. W. Ayer & Son's, publishers, 1887. Price $3.00.

This useful publication contains a carefully prepared list of all newspapers published in the United States and Canada, arranged by States in geographical order, and by towns in alphabetical order. The list gives the name, issue, general characteristic, year of establishment, size, subscription price and that very erratic quantity, the circulation. This last edition is a decided improvement on preceding issues in giving the names of editors and publishers and in stating subscription price and street address. The population as given for States, Territories and almost every town where a newspaper is published, is also a good thing.

The Coming Deluge of Russian Petroleum, and its bearing on British trade. By CHARLES MARVIN, author of "The Russians at the Gates of Herat," etc. London, R. Anderson & Co., pamphlet.

This pamphlet is written to prove that Baku, and not America, is to supply the world with petroleum, and that the English are being left behind in the race for its transport. It is full of very interesting facts, and seems to make out a pretty strong case. The yield of the Baku wells is enormous (one flowed for a time at the rate of 2,750,000 galls. *per day*) and their average depth only 462 ft. It seems to us more than probable that the relative importance of the American supply will continue to decrease.

Modern American Methods of Copper Smelting. By EDWARD D. PETERS, Jr., M. E., M. D., M. Inst. M. E. Former Govt. Assayer of Col.; late Supt. Orford Copper & Sulphur Co.(and other mining companies), New York. Scientific Publishing Co. pp. 342, 6 × 9 ins., numerous plates, fair index. $—.

This very handsome and well printed treatise we take to be beyond question the most complete treatise on copper smelting in existence. It is full of detailed statements of cost, and bears on every page the stamp of a thoroughly practical work.

The Relative Proportions of the Steam Engine, being a rational and practical discussion of the dimensions of every detail of the steam engine. By WILLIAM DENNIS MARKS, Ph. B., C. E. Whitney, professor of dynamical engineering in the University of Pennsylvania. Third edition, revised and enlarged. Philadelphia; J. B. Lippincott Co., 1887. pp. 295, 5 × 7½ ins., 70 cuts, interleaved. $3.00.

This volume, whose character is pretty well vouched for by its use in such schools as Stevens Institute, is probably very well known to mechanical engineers. The new matter in the present edition is principally in the chapter on the limitations of the expansion of steam, which now occupies a space of 67 pages, and contains the results of some careful experimental work by the author. We hope to discuss it at some length in a later issue.

The Metallurgy of Silver, Gold and Mercury in the United States. By THOMAS EGLESTON, LL. D. Prof. Mineralogy and Metallurgy, School of Mines, Columbia College. In 2 vols. Vol. 1. *Silver*. New York, John Wiley & Sons; *Engineering*, London. pp. 558, 8 vol., extremely well indexed; 189 cuts, many tables. $7.50.

This is another of those complete and elaborate treatises on special subjects, of which the American press is getting to produce so many. It is, beyond question, the best on its subject in print. An omission which will cause annoyance is that the volume is not marked in the back as "Vol. 1—Silver" only, but purports to be the whole treatise.

The Landes and Dunes of Gascony.

When Major F. BAILEY, R. E., last year visited Gascony for the purpose of examining the pines of the country, he also paid special attention to the construction of the works for their protection against the sand, which, unless proper precautions were taken to prevent its advance, would have overwhelmed them.

The dunes are formed by the combined action of the wind and sea. Each ebb tide leaves a quantity of sand, a portion of which dries before it is covered by the next flow, and it is then liable to be blown away by the wind. Thus sand hills or dunes are formed which rise sometimes to a height of from 200 to 250 ft., the line of their crests being generally perpendicular to the direction of the prevailing wind.

The sand hills themselves are kept moving slowly landward by the wind, which drives the upper layer of sand from the gently sloping outer face up to the summit, whence it falls down the steep slope on the landward side, and thus the dunes are rolled inland by slow degrees. The average annual rate of the advance of sand is said to be about 14 ft. per year.

As the source of the evil lies at the sea beach, and since, as regards the dunes already formed, the movement at any particular time is confined to the sand then at the surface, if this sand can be fixed, during the time necessary to make a crop of herbs, shrubs, and young trees to be raised upon it, the movement of the entire mass will have been arrested.

The works for this purpose are commenced as follows: At a distance of about 165 yds. from high water mark, a wattled fence 40 in. high is erected. This seems to arrest the sand which is heaped up on the seaward side, a portion of it filtering through the wattles. After a time the fence is overtopped, and the sand, blown up the outer fence, forms a steep slope on the other side. A second wattled fence is then erected about 6½ ft. behind the first, and the space between the two becoming filled up, and a mound rising over it, the sand which falls over stands at a high angle against the reverse side of the second wattle.

In the center of the mound a palisade of plank, 40 ins. above and 20 ins. below ground, is erected, these planks which are 7 and 8 ins. wide and 1.15 ins. thick, being placed ¾ of an inch apart. When the sand drifts up against them, a portion falls through at intervals, thus affording support on the other side, and when they have become nearly covered, they are raised about 2 ft. out of the ground by means of a hand lever and chains. This is repeated from time to time until the carrier has attained a height of about 25 ft. when a third wattle fence is constructed, at a distance of from 5 to 6¼ ft. behind the inner slope, and the top of the barrier is strengthened by means of a line of small fagots, which are half buried vertically in the sand. The fagots, each of which weighs about 45 lbs., are placed at distances of 4½ ft. from center to center.

During the time that elapses before the last fence is overtopped the palisade is not raised, so that the width of the base is increased and the top becomes broader and rounded. When the palisade, which is now moved back a short distance, is overtopped, it is raised as before, an additional wattle being placed in the rear of the work; and the building up of the mound by the action of the wind is continued in this manner until it has attained its maximum height of from 40 to 45 ft. when its breadth is allowed to increase, until it stands on a base about 330 ft. broad. The foot of the outer slope is then about 100 ft. distant from high water mark, the top being at least 165 ft. broad and the slopes standing at thirty-five or forty degrees.

This result is usually attained in from fifteen to eighteen years. The surface of the mound is consolidated by fagots 12 to 14 ins. in circumference and 14 to 16 ins. apart, buried vertically to a depth of 16 ins. in the sand and projecting 8 to 16 ins. above the ground. It is also sown with *gourbet* (*Arundo arenaria*), about 13 lbs. of seed being used to the acre.

An artificial dune, constructed in the manner above described, now extends along the coast for a distance of 125 miles, from the Gironde to the Adour.

As soon as the further importation of sand over the country has been arrested by the palisade, a mixture, consisting of 11 lbs. of pine seed, 7 lbs. of broom seed, and 5 lbs. of gourbet per acre, is then sown on it broadcast, a palisade being at its inner limits, so as to prevent the seed from becoming buried under sand carried over it by land breezes. This structure is moved back as the work progresses, so as to serve for the protection of other belts. The seeds are covered with branches and brushwood, laid like tiles, with their butt ends toward the sea, and kept down by means of sand thrown upon them. The cost of the entire work is said to be about forty dollars per acre.—*Lumber Trade Journal.*

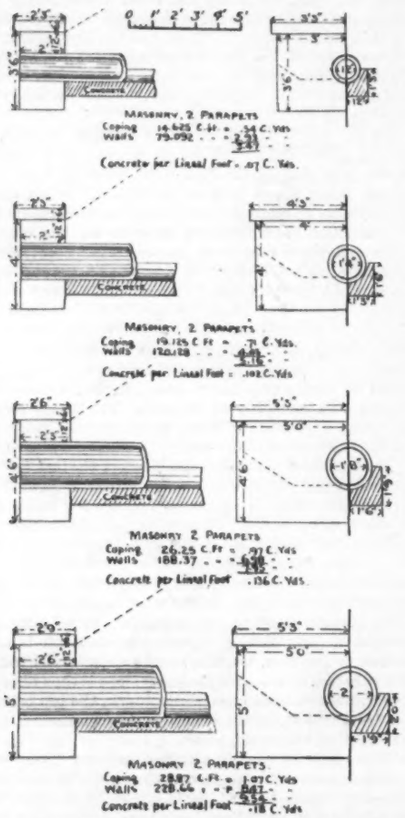
A Lively Stockholders' Meeting.

The *Nashville American* recently published the following graphic description of the annual meeting of a Tennessee Railroad Company:

"Speeches, epithets, fights and running over men and chairs made things so perilous that your correspondent thought it unhealthy to attempt an entrance. We remained up stairs in the same building and heard the lawyers roar. As soon as the pugilists leave, if they do not do up the Secretary and chew up the books, a report of the proceedings will be sent in. In the melee two attorneys on opposite sides clinched, and when they made for each other, the hall was quickly cleared. Two other gentlemen tried to comb each other's head with chairs. It was the liveliest little stockholders' meeting ever held here."

Standard Pipe Culverts; Kansas City & Omaha R. R.

In continuation of our standard construction plans on the Kansas City & Omaha R. R., we give this week a series of sectional drawings of pipe culverts, ranging from 12 in. to 2 ft. in diameter of opening. The plans also give bills of quantities which convey a clear idea of relative cost.


MASONRY, 2 PARAPETS
Concrete per Lineal Foot = .07 C. Yds.
MASONRY, 2 PARAPETS
Concrete per Lineal Foot = .102 C. Yds.
MASONRY 2 PARAPETS
Concrete per Lineal Foot = .136 C. Yds.
MASONRY 2 PARAPETS
Concrete per Lineal Foot = .18 C. Yds.

It should be remembered that these culverts are designed for a prairie country where suitable stone for culvert masonry is scarce and dear, and where wood must be used for cases where water is expected only under exceptional circumstances, and tile is used where a continual flow is to be looked for. The designs shown in this issue are applicable, however, to other sections better supplied with stone and are well worth preservation and study.

The Westinghouse and Thomson-Houston Electric Companies Combine.

The public announcement is made of what has been known to a few for several months past, that an agreement has been made between the officials of the Westinghouse Electric Co. and the Thomson-Houston Electric Co. The terms, as far as made public, are as follows:

The Thomson-Houston Co. recognizes the validity of the Gaulard-Gibbs patent, owned by the Westinghouse Electric Co., and has taken a perpetual license under it for the New England States. Hereafter the Thomson-Houston Co. is to enjoy the right to manufacture and supply the alternating current apparatus in the New England States, and also for some 200 local companies which it has already established outside those limits; this will give that company a large amount of additional business in incandescent lighting wherever its arc lighting plants are now in operation.

The Westinghouse Co., on the other hand, acquires the right to supply the electric lighting apparatus and introduce and sell the arc light plants of the Thomson-Houston Co. on favorable terms all over the United States, and at the same time secures from its competitor the recognization of all its alternating patents, as well as the payment of substantial royalties thereunder.

The Westinghouse alternating current system, although on sale for less than a year, already has in operation over 100,000 central station incandescent lights, and under the influence of this combination it may safely be predicted that the growth of the system will be even more rapid in the future.

The factories of the two companies, one at Pittsburg, the other at Lynn, are models of their kind, and are collectively of enormous capacity. They will be able to turn out all the apparatus required for 5,000 or 6,000 lights per day. No such important combination of electric lighting interests has heretofore been made, either in America or Europe; and thus these two companies are placed in an unexcelled position with reference to the electric lighting business of the country.—*Electrical Review.*

Report of the New London, Conn., Water Commissioners.

The Water Commissioners submitted their 16th annual report at the annual city meeting held last month. The rainfall of the year was heavy, 53.08 ins. at the lake. For a few days in May and June the Konomoc water was unpleasant to the taste and smell, although the mains had been flushed only 16 days before the odor was noticed. The matter was reported on by Dr. A. R. LEEDS, of Hoboken, N. J., and as the cause is shown to be contact with vegetation in the shallow inlets, it is suggested that these shallows be cut off from the lake. Lead has been substituted for cement lined service pipe except where the latter is specially requested. The works are reported to be in fair condition, except that the hydrants require a large amount of repairs, owing in a great measure to their use by street watering carts. The works were constructed in 1872 and are owned by the city. The source of supply is Lake Konomoc, which has an area of 225 acres, and a capacity of 600,000,000 galls. The estimated population is 13,000; 11,300 on the line of pipe and 9,327 supplied.

The total consumption of the year is estimated at 400,000,000. The distribution system consists of wrought iron, cement lined and cast-iron pipe, from 4 to 16 ins. diameter. During the year 4,340 ft. of pipe, have been laid, 6 hydrants and 6 gates added. The system now comprises 25.8 miles of pipe, 136 hydrants, 108 gates, and 17 blow-off gates. The cost of repairs per mile was $24.94 and the number of leaks per mile 1.5. The range of pressure on the mains at the office, for day and night, is 32 to 55 lbs. The services consist of wrought-iron cement-lined, galvanized, cast-iron and lead, from ¾-in. to 4-ins. diam. During the year 103 service taps have been added, 4 meters and 2 motors and elevators. There are now in use 1,755 taps, 40 meters and 13 motors and elevators.

In the special report of the Superintendent on the action necessary to increase the pressure in the higher parts of the city he states that the city is supplied at present through 6,878 ft. of 24-in. pipe terminating with a head of 18¾ ft., thence the supply continues through 27,249 ft. of 16-in pipe terminating at Broad street under a head of 80 ft. After showing the consumption per tap in various cities he comes to the question whether it is cheaper to check the waste or increase the supply. The cost of a slight increase in supply is estimated at $70,000 and the cost of metering every service about $28,000. He recommends that an ordinance be established punishing waste by fine, that the rules and regulations be revised, that meters be adopted by all places using large quantities of water, and that a thorough and continual inspection be undertaken. The report is accompanied by a table of meter rates of various cities. BENJ. A. ARMSTRONG is President of the Board of Water Commissioners, and W. H. RICHARDS is Engineer and Superintendent.

IT has often been alleged recently that Russian petroleum was upon the verge of driving American from the foreign markets. It may be that it is, for certainly there appears to be a very wonderful oil field in the neighborhood of Baku, but certainly there has been as yet no very alarming inroad made upon our foreign trade. According to the latest report our exports were:

		Galls.	Value.
Month of September,	1887	54,239,560	$4,013,189
	1886	56,171,231	4,305,223
9 months ending "	1887	428,272,439	33,349,547
	1886	433,236,968	35,546,313

The falling off, which is trifling at best, is less for the last month than for the last nine months.

THE Italian and Swiss delegates have signed at Berne a convention relative to the Simplon tunnel. Switzerland is to contribute $3,000,000; the Italian Government, $1,000,000 and the provinces and towns of Upper Italy, $2,000,000. French financial establishments are said to have subscribed for $15,000,000 ordinary and preference shares.

The San Mateo Dam.

The San Mateo Dam, now being built about 20 miles from San Francisco as a storage reservoir for the Spring Valley Water Co., is interesting on account of its dimensions and from the fact that it is being constructed entirely of concrete. A correspondent of *Fire and Water* describes the methods adopted by Mr. HERMAN SCHUSSLER, the Chief Engineer. The excavation is laid bare to the bed-rock, and the concrete is manufactured by means of an exceedingly complete plant on the spot, including stone-crushers, sand-bins, mixers, mixing platforms, etc. The concrete is made in the proportions of 22 cu. ft. of crushed rock, 1 barrel of Portland cement and 2 barrels of sand; this is all delivered in a chute leading to the mixer from which the concrete falls into cars to be run out on the dam. The capacity of the mixer is about 10,000 cu. ft. of concrete per day. In placing the concrete, the rock is first made thoroughly clean and then a frame-work of wood is set for making a concrete block. These frames vary in size, being 20 ft. or less square and 6 ft. high; the concrete is dumped into these moulds from barrows and rammed with heavy iron rammers. When filled, the mould is covered with boards, kept wet for a while and allowed to set for 7 to 10 days before the mould is removed. These concrete blocks are not truly rectangular in plan, but have an inset about the middle of each side of a block, and opposite to each other in adjoining blocks, making a nearly square key or plug in the joint filling; some of the blocks are nearly L-shaped in plan, others approximate an H-form and all break joint. The general dimensions of this dam are: height, 170 ft.; width at base, 176 ft.; width at top, 20 ft.; slope on water-side, 1 ft. horizontal to 4 ft. vertical; slope on lower side, 2 ft. horizontal to 3 ft. vertical. As shown on a rough sketch, these slopes are straight lines from top to bottom, and the dam is on a curve with a radius of 637 ft. The area of the reservoir is 1,000 acres, and the storage capacity 32,000,000,000 galls., at an elevation above tide of 300 ft. To draw off the water, a shaft 14 ft. in diameter is sunk in the rock at one end of the dam, and four tunnels lead to this from the reservoir with four similar outlet tunnels on the other side; a 44-in. gate controls the mouth of each tunnel.

Battle Creek Station Specifications.

(*Concluded from page 247.*)

PLASTERING.

Lath.—Lath the ceiling of Ladies' Lavatory, Ticket Office, and Telegraph Office and all the furring strips throughout main building with dry white pine laths, free from all knots and sap; laths to lay ¾-in. open.

Plaster.—All the above mentioned lathing below the ceiling, will be plastered with the best two coat work, carrying the first coat of plaster down to the floor in all cases.

First Coat.—The first coat will be composed of the best mortar, composed of well-burnt lime, and clean sharp sand, mixed with plenty of good, sound, long cattle hair.

All walls and angles must be straight, and plumb and all plaster angles will have wood bead grounds.

All walls will be well troweled and hand floated.

Granulated Finish.—The second coat throughout will be a rough granulated, finish, of lime and coarse, clear sand, thoroughly troweled and well put on.

Bead.—All the large interior arches will have large plastered beads on corners, stopped as shown.

CARPENTRY.

Framing.—All framing where no particular timber is specified will be of Norway pine, good, sound, dry, square edged, and well seasoned, free from large or loose knots, shakes, sap, or other imperfections which will tend to split or otherwise weaken the timber.

Timbers.—The main floor joists of both buildings will be 2 x 12 ins. — 10 in. c. c. The floor joists of Telegraph office will be 2 x 10 ins.—12 in. c. c. The joists of the different floors of tower above Telegraph office will be 2 x 10 ins. — 16 in. c. c. These joists will all be anchored to wall by ¼ x 1¼ ins. wrought-iron anchors,—one anchor to every 5 ft. The ceiling joists of both buildings will be 2 x 10 ins. — 16 c. c.; ceiling beams of main building being supported at center to trusses. Rafters of main building will be 2 x 8 ins. — 16 in. c. c., with 2 x 12 ins. hip and valley rafters. The rafters of Baggage house will be 2 x 10 ins. — 16 in. c. c., with 2 x 10 in. hip and valley rafters and 1 x 6 in. ties; the ridge piece of main building will be 2 x 3 ins.— of Baggage house 2 x 10 ins: rafters of tower will be 2 x 8 ins.— 16 in. c. c.

Wall plate of main building will be in two pieces, each 2 x 12 ins.; wall plate of Baggage house—two pieces each 2 x 8 ins. Wall plate of tower—two pieces each 2 x 10 ins. The different pieces of all the wall plates will be laid lapping ends, and well spiked together, and anchored to walls, by ¾ in. round anchors, 2 ft. long with 4 x 4 in. plate at lower end and washer-screw and bolt at upper end. All the anchors for wall plate and for joists will be furnished by carpenter.

The ends of floor and ceiling joists will all rest directly on the walls, with no bond timber in building except blocks for door jambs. The timbers under platform floor will be 4 x 4 in. hemlock—laid 30 in. c. c., and firmly and evenly bedded on the earth to give a regular pitch from the buildings as directed. Contractor will include all the platform shown on the ¼ in scale plan.

Headers and Trimmers.—There will be headers and trimmers around all openings for stairways, chimneys, dormers, etc., composed of two joists spiked together and framed to other timbers. The headers and trimmers for hearth of large fire-place will be three floor joists spiked together and framed. There will be headers and trimmers framed around an opening in each of the tower floors above Telegraph office. No floor or ceiling joists or other constructional timber must come within one inch of any smoke flue.

Bridging.—Each floor and ceiling will have 1 x 2 in. double herring bone, cross bridging, in continuous rows from end to end, perfectly straight, at rate of one row to not more than six feet; to be cut in and well nailed at each end.

Roof.—The roof of main building will be built as shown. With trusses, purlins, etc., all firmly framed together and roof made rigid in every way with all necessary bolts, ties, plates, etc. There will be two large trusses over ladies' room and two over gentlemen's room; also one smaller over gentlemen's room at corner of tower, these trusses will be made of 4 x 10 in. principals, 4 x 10 in. lower chord, with 4 x 8 in. struts and 1¼ in. tie rod. The principals and lower chord will be tied together by 1 in. bolts with necessary plates and washers. The 1¼ in. tie rod will have 5 x 5 x ¼ plates at top and bottom with washers, etc. These trusses, together with the brick piers, which are built up for that purpose, will support 4 x 10 in. purlins, and be firmly fastened to them. The roof of tower will have 1 x 8 in. boards crossing diagonally from corner to corner, and well fastened to wall plate. The roof of Baggage house will be well and thoroughly framed with timbers as specified, and made complete in every respect.

The rafters of dormers will be 2 x 6 in., with wall plate, two pieces each 2 x 4 in. The wall plate of main building will be extended across circular base and to support same 4 x 10 in. beams under each plate will be used.

Shed Roof.—The projection of roof forming the protection to platform, also the extension of this roof connecting main building with Baggage house, will have 4 x 10 in. rafters, 30 in. c. c. supported by 4 x 10 in. purlin, and this purlin by brackets 6 in. wide and cut as shown, brackets resting on the stone corbels. The purlin supporting roof, just in front of large window in ladies' room, having a long span, will be trussed with 1¼ in. tie rod and iron struts, with plates, washers, etc., at end of ties. The rafters will be fastened to wall-plate and have ends cut as shown. All these timbers will be dressed with edges rounded, and as shown on drawings; brackets to have a 4 x 6 in. piece against wall, for foot to frame into, these pieces to be well fastened at top also.

There will be moulding as shown at junction of the finished side of shed roof with the brick work.

The extension to baggage house will rest on three 6 x 8 in. posts placed about 12 ft. apart with 6 in. thick brackets, 6 x 8 in. tie for brackets and 4 x 8 in. purlins, all dressed and finished as timbers for other shed roofs. All the shed roofs will have on under side of roof boarding and between the rafters ⅞ x 3 in. matched ceiling, with a small bead in corner of rafters. All this finished work, brackets, purlins, posts and ceiling will be of fine common white pine.

The Porte Cochére will be built as shown, with gable, etc. In gable there will be a moulded cornice, level and running up rake, with brackets projecting to support cornice. There will be large beams spanning the driveway, the beams 10 in. wide, and boxed with ⅞ in. stuff with lower corners rounded. The ceiling of porte cochére will be matched and beaded ceiling stuff, with small moulding all around. All this finish, beams, brackets, ceilings, etc., will be of fine common white pine. The gable will be tiled. The bay in gable will have carved bead on angles and moulded and carved corbels, all as shown.

Roof Boarding.—Cover all the roofs of both buildings, also roofs of dormers and shed roofs, with 1¼-in. good, common matched roof boards, not over 8-in. wide, and free from all large or loose knots. The roof of bays, and of extension to Baggage house will have valleys filled out and rounded so as to show no valley lines. The eye-winkers will gradually grow out of main roof, all as shown.

Saddle.—Make a large saddle behind the tower, to shed water, and elsewhere if necessary.

Tower Cornice.—The tower roof will have a small moulded cornice as shown, and corbels 6 x 8 in. with rounded edges and ends to support overhang; soffit to be ceiled with ⅞ x 3 in. ceiling stuff.

Dormers.—Build and construct all the dormers as shown on drawings, with 4 x 4 in., studs, 16 in. c. c., and rafters as specified, with moulded cornice and corbels under moulded sills and transoms, and moulding running up rake. The jambs, mullions and gables being covered with tiles. The eye-winkers will be built as shown, being made to gradually grow out of roof in every way.

Ladder.—Build a good pine ladder, from Telegraph office to floor above, and one from each story above this to top of tower. Fasten all in place, except the lowest one which will be made movable: make a scuttle in Telegraph office ceiling. Put on with hinges and hooks.

Studding.—The two 4 in. brick partitions on side of staircase to Telegraph office, will be built by first putting up 2 x 4 in. studs, 18 ins. c. c., well fastened at head and foot, and then filled in between with brick work. The partition forming vestibule to gentlemen's lavatory, will be made of 2 x 4 ins. stud 16 in. c. c. Doubled at corner and around door.

Furring.—All the brick walls, exterior and interior, of first story of main building, also of Telegraph office, will be furred with 1 x 2 in. strips set 16 ins. c. c.

Cross Furring.—The ceiling of Ticket office, and the ceiling of Ladies lavatory, will be cross furred with 1 x 2 in. strips 16 in. c. c.

Floors.—The first floor of Main building, where not tiled, and also the floor of Telegraph office, will be double, the under floor being made of common, dressed, dry 1½ in. hemlock. Boards, not over 8 in. wide laid breaking joints and well nailed to every joist.

The finished floor of Main building (first story) will be hard maple ⅞ x 2¼ in. wide, with a border made of three widths of maple, one of red oak, one of maple and one of oak, each strip 2½ in. wide. The finished floor of Telegraph office will be best selected, common matched white pine floor boards, not over 6 in. wide. All upper floors will be laid breaking joints, blind nailed, tightly strained, and smoothed down to a uniform surface, and the whole cleaned off at completion of building. No hard-wood floor will be laid until after all plastering shall have been finished.

The floor of Baggage house will, in baggage room, express office and lavatory, be single and made of two inch (2 in.) thick white oak planks, matched and dressed and not over 3 in. wide. The floor of each story of tower above Telegraph office will be common, matched floor boards, laid breaking joints. The entire floor of platform around both buildings will be single, made of common dressed dry pine planks 2 in. thick and not over 6 in. wide well laid and securely nailed with 30-lb. nails.

Windows.—All windows on first story of main building and Telegraph office below the transoms, will have box frames ⅞ in. thick, with 2 in. sills, all windows of Baggage house will have similar box frames; five of the openings below the transoms of the large window in ladies' room will have box frames; all other windows will have solid 2 in. frames and 2 in. sills. All windows with box frames will have double hung sashes with round cast-iron weights of accurate balance, with the sashes, best hemp cord, and best pulleys; the pulleys on first story of main building will be bronze face, No. 14, 2¼ in. (H. & D. Mfg.), with steel axle. All sashes will be 1¾ in. thick, of clear white pine, and those on first story of main building will have a red oak veneer on the inside, all sashes will be thoroughly seasoned and moulded, coped and lipped at meeting rails.

Of the windows with solid frames, the upper transoms of all the windows having double transoms, will be hinged at bottom on 3 x 3 in. plain bronze hinges, and have bronze Wollensack transom openers, ⅜ in. thick, and to come down to within 5 ft. of floor. The center opening above transom of large window in Ladies' room, the center opening below the transom of high circular window in Ticket office, and the opening above transom in Telegraph office, will be hung in same manner, and have similar transom openers, window in Ladies room to have 4 x 4 in. hinges.

Of the windows of Tower above Telegraph office, one in each of the group of five, at top will be hung at sides, with bolt to keep shut, all others stationary. One window in each of the dormers will be similary hung, other stationary.

All double hung windows of main building will have plain bronze Ives sash fastenings, No. 634 and in upper sash plain bronze plate, No. 631, for lowering sash, and in lower sash plain bronze sash lifts, No. 806, two in each sash. In Baggage room windows will have bronzed iron Ives sash fastenings and bronze iron sash lifts, two to a sash. Furnish one tapering oak pole 6 ft. long, 1¼ in. in diameter at base, and having at head a hook, No. 634 for lowering sash of windows.

Doors.—The outside doors of main building will have moulded frames 1¾ in. thick; the inside doors will have frames 1⅜ in. thick. All frames will be of red oak, the Baggage house doors will have frames 1¾ in. thick, of clear pine, with oak guards 3 in. thick and 5.10 in. high. The outside doors of main building, will be 2¼ in. thick, paneled and moulded with raised panels etc., upper panels glazed, and all as shown on detail drawings and of oak. All inside doors of main building will be 1¾ in. thick, of sizes shown or figured, and will be paneled and moulded, with raised panels, and all of oak. The closet partition doors of Ladies' lavatory, will be 1¼ in. thick, and 5 ft. 6 in. high with open space 12 in. high below, and 10 in. high above, and to be moulded and paneled with raised panels, of oak, as other doors. All hardwood doors will be veneered ⅛ in. thick on a pine core; the doors of Baggage house will be 1¾ in. thick, of clear white pine, closet doors 1¼ in. thick, and 5 ft. 6 in. high and to be raised 12 in. above floor with 10 in. open space above. And all these doors to be paneled and moulded with raised panels; all doors will have hardwood thresholds, and oak steps with rubber tips.

Hardware.—(Details chiefly taken from catalogues and omitted.—ED.)

Inside Finish.—All the finish of main building will be clear red oak, except in Telegraph office, which will be clear white pine, all finish will be 2 years air dried and also thoroughly kiln dried. This last to be done on the work.

Architrave.—All doors of main building will have moulded ⅞ x 4 in. architraves. Over the doors there will be in addition a moulded cap 7 in. high. All architraves will be mitred at heads, and those around doors will run down to floor. The architraves of windows will stop on moulded stools, with moulded aprons ⅞ x 3 in. The doors and windows of Baggage house will have plain ⅞ x 4 in. architraves, with corners rounded. The windows will have plain stools with plain ⅞ x 3 in. apron, with corners rounded.

The Stairs up to Telegraph office will be strongly constructed on 2 x 12 in. carriages, and will have open string 4 x 4 in. turned newels, 2½ x 3½ in. moulded hand rail, and 1⅜ in. turned balusters, three to a tread; in the Telegraph office, to shut off the stairs from room, there will be a moulded rail, 2 x 4 in. with 1¼ in. balusters, 2 in. apart. In rail, a hinged gate, with 4 x 4 in. newels each side of gate. Gate hung on strong bronze hinges and to have a strong bronze catch on inside. All these rails, balusters, etc., will be of red oak.

CONSTRUCTION NEWS.

Water.

Belvidere, N J.—The entire plant of the Belvidere Electric Lighting Co., comprising a complete outfit, was sold Oct. 18, to GEORGE F. WILEY, of Philadelphia, Pa.

The Peru Electric Light & Water Supply Co., of Peru, Ill., has been incorporated by W. K. HOAGLAND, W. E. MOORE, and others. Capital stock, $800,000.

Drainage in Quebec.—The Chateauguay county council wants $2,500 from the Government to aid in a drainage scheme by deepening Norton's creek. The Government declines to advance the money unless a sufficient sum is guaranteed by those interested to complete the work, which will cost about $5 000.

Bad Water Supply.—Olean, N. Y. Chemist VANDERBERG, of Buffalo, who has tested the city water, has reported to the Board of Health that it is unfit for use, being the poorest water used in any place in the State. ——Bellefontaine, O. The State Board of Health has condemned the city's water supply.

Kansas City, Mo.—The new water-works system near Quindaro was formally opened Oct. 18 and the city is now supplied with water from the Missouri river instead of from the Kaw. It is calculated that the system now in operation would be amply able to supply a city with a population of 500,000. The total daily capacity of the works is now 24,000,000 galls.

Gas and Electric Light.—*Anniston, Ala.*—The plans and specifications are being prepared for the gas works to be built by T. G. FOSTER, of Montgomery, Ala.

Americus, Ga.—The franchise for gas works has been granted to W. F. ELLIS, Jr., of Montgomery, Ala.

Concord, N. C.—The Concord Electric Light Co. is to be organized to put in a lighting plant. Address W. H. ODELL.

Little Rock, Ark.—The Pulaski Gas Co. will put in an electric light plant.

San Francisco, Cal.—The Standard Gaslight & Fuel Co. has been incorporated by H. MCGURREN, of Chicago, BENJ. D. DUNCAN, of San Francisco, and others. Capital stock, $3,000,000.

Los Angeles, Cal.—The Los Angeles Petroleum Gas Co. has been incorporated by WM. LACY, CHALMERS SCOTT, and others. Capital stock, $500,000.

Xenia, O.—The franchise for the new water-works was obtained in 1886. The supply is obtained from springs, which supply a reservoir with a capacity of 6,325,600 galls. The system is combined direct pumping and stand-pipe, the stand-pipe having a capacity of 300,000 galls. The pump house contains two Gordon & Maxwell compound condensing engines with an aggregate daily capacity of 4,500,000 galls. There are 19 miles of mains and the water is pumped to the town through 14-in. pipes; there are 200 fire plugs, for which the city will pay an annual rental of $7,500. The contractors were Goodhue & Birnie, of Springfield, Mass.

The works are owned by the Xenia Water Co., which has a capital stock of $200,000; President, JOHN P. MARTIN; Treasurer, WM. BIRNIE; Secretary, H. MCQUISTON; Superintendent, G. F. COOPER. The works have been tested and accepted.

Burning Sewage.—It is curious that just as we in London are spending scores of thousands of pounds in establishing a system of getting rid of our sewage by throwing it into the sea, the Parisians are seriously experimenting with a view to destroying their accumulation of sewage deposits by burning it. They seek to effect by fire what we intend to do by water. Before cremation can be generally applied to sewage matter, however, there must be a guarantee that the process of burning will generate no foul odors, and it is said that a recent invention enables the promoters of the new system to give that guarantee. The issue of the experiments should be closely watched by the long-suffering London rate-payers, for if burning is practicable it ought to be cheaper to carry out than the shipment of the solid sewage to some point well outside the Nore.—London (Eng.) *Figaro*.

[Experiments on the disposal of sewage by burning are now being carried on in New York.—ED.]

Driven Wells at Lincoln, Neb.—Joseph Burns, the contractor for furnishing the additional water supply, has finished driving the wells, making a total of 80, which should, according to the contract, furnish 2,000,000 galls. per day, but the test of each well as soon as driven showed a supply of 70 galls. per minute, or a total of over 8,000,000 galls. per day. The entire time in actual labor of putting down these wells was about 22 days or nearly an average of 4 each day. This method of sinking the wells gives the best results known to well men and so far has never been equalled in Nebraska, if anywhere.

San Francisco, Cal.—The total amount of gas consumed in the public buildings and by the Fire Department, as supplied by the San Francisco Gaslight Co., during the year ending June 30, 1887, was 2,984,800 cu. ft., which, at $1.75 per 1000 cost the city $5,223.40. The number of street lamps in the city's service during the year was 5,100. The capacity of this company's works is 5,000,000 cu. ft. per day, and it has 220 miles of mains laid. The capacity of the works of the Pacific Gas Improvement Co. is 1,500,000 cu. ft. per day and it has 67 miles of mains laid.

The monthly bills presented by the Spring Valley Water Co. for water supplied for municipal purposes during the year, aggregated $70,770.48. The total number of fire hydrants in service Aug. 31, 1887, was 1,502. The city supplies the hydrants and rents at a cost of $33 per hydrant. The Spring Valley Water Co. connects the same to their service at a cost to the city of $45 for new hydrants and $25 for resetting each old hydrant.

The Taste and Smell of Water.—Dr. ALBERT R. LEEDS has written to the N. E. Water-Works Association asking their co-operation in a study of the origin of the taste and smell affecting most water supplies. The data required is embraced under the following heads, and any observations made should be forwarded to Dr. LEEDS at the Stevens' Institute of Technology, Hoboken, N. J.:—

I. Nature of Tastes, Colors, Odors and Objections.
II. The years, times and seasons of occurrence.
III. The related appearances, growths, organisms, temperatures.
IV. Sources of supply; amount; manner of collection; reservoiring and distribution, so far as they may possibly throw light upon the nature of the difficulties encountered.
V. Where the troubles have occurred—in collecting basins, reservoirs, pipes, dead ends. Their connection with stagnation at any point; shallow water; swamps; contaminations.
VI. Prior investigations and analyses; explanations given by yourself and others.

New Water-Works.—*Maine.*—Machias. The supply will be drawn from two streams and Lily lake. A reservoir will be constructed with a capacity of 3,000,000 galls. The lake will be used as a supplementary source of supply, and a dam will be built at the foot to increase its capacity. R. ROSE is the engineer in charge of the water supply investigations.

Massachusetts.—Monson. Water-works for fire protection are proposed.—Marblehead. The new water-works which were tested recently were found inefficient.

Connecticut.—Great Barrington. The Berkshire Heights Water Co. will soon have its works completed.

New York.—Springville. The water has been let into the reservoir, and the town will soon have a supply.

New Jersey.—Jersey City. GEO. H. TITCOMB has made an offer to deliver water at Belleville for $32 per 1,000,000 galls. He proposes to build a 5,000,000 plant in 15 months, the city to have the right to purchase it within 10 years. The Board of Works referred the matter to a committee.—West Orange. The Township Committee has under consideration a plan for a water supply; DAVID N. ROPES, of Orange, has offered to sell a source of supply owned by him, or to organize a company and supply the water under contract.

West Virginia.—Clarksburg. The town has voted $50,000 for water-works, and a survey will be made shortly, after which bids will be advertised for. There will be two direct acting steam pumps and two brick cisterns with a capacity of 250,000 galls. each. T. M. JACKSON is the Engineer in Charge.

Kentucky.—Covington. The masonry on the reservoir is progressing rapidly; work will be carried on during the winter and the water-works completed in the spring.

Tennessee.—Johnson City. The water-works will be built by parties from Charlotte, N. C., but not by the Charlotte Water-Works Co.

Georgia.—Griffin. Water-works are contemplated.—Americus. The works will be built by W. F. ELLIS, of Montgomery, Ala.—Marietta. Estimates are being made by P. B. LAWRENCE, of Atlanta, but it is not yet certain whether the town will have the works.—Valdosta. A proposition to build water-works has been made by JETER & BOARDMAN, of Brunswick.—Macon. Work is in progress for the new water supply and the new pumps with a daily capacity of 1,250,000 galls. have been put in. Capt. WILCOX is in charge of the works.

North Carolina.—Hendersonville. Water-works are contemplated.—Charlotte. The city has annulled the contract with the water company and bids will be invited for building new works. Address F. B. MCDOWELL.

Florida.—Lake City. Water-works will be built by N. S. Collins & Co., who have been granted a franchise.

Alabama.—Eufaula. The Eufaula Water Co. has commenced the construction of the water-works. The supply will be from artesian wells. General Manager, A. H. HOWLAND; Constructing Engineer, W. F. ELLIS, Jr.; Superintendent, R. H. WALKER.

Michigan.—Harrisville. Water-works are contemplated.—Lowell. The water company has its works nearly completed.

Illinois.—Bunker Hill. Water-works are projected.—Elgin. The works are approaching completion.—Staunton. The village wants water-works and surveys have been made for two reservoirs, one of which will have a capacity of 100,000,000 galls.; the dam will cost about $11,000. Work will not be started this season.

Minnesota.—Fountain. An artesian well to give a water supply to the village is to be drilled by Herriman & Meadowcraft.

Iowa.—West Burlington. Water-works for fire protection are to be established; it is proposed to lay 2,500 ft. of 6-in. water-pipe, with hydrants, etc., at a cost of about $5,000, for which bonds will be issued.

Montana.—Helena. The new water-works being built by Turner, Clarke & Rawson, of Boston, Mass., under the Woolston franchise are under construction; pipe is being laid. The old company is extending its system.

Nebraska.—Omaha. The water company will commence work at once on its extensions. Pipe for the extension to Florence and for city extensions has been purchased from the Cincinnati & Newport Iron & Pipe Co., of Newport, Ky., for $400,000. The pumping capacity of the new works is 15,000,000 galls. per day.—Long Pine. The tank for the new water-works will be 24 ft. diameter and will stand on a trestle tower 20 ft. high. The mains will be 4-in. and 6-in. diameter.—Nebraska City. A section of the water-works has been put in operation.

Colorado.—Glenwood Springs. The water-works are under construction.

California.—Anderson. A survey is being made for the large ditch for the Anderson Water Co., and as soon as this is completed, the works will be commenced.—Santa Rosa. A company has been organized by T. J. BROOKS, J. B. DAVIS, and others, to supply water for irrigation and domestic purposes from Mark West creek, conveying the water through iron pipes.

Texas.—Corpus Christi. The city has decided to establish water-works and has advertised for proposals for sinking an artesian well to supply 50,000 galls. per day. Contracts for material and pipe laying will be let as soon as water is obtained. Address JULIUS HENRY, Chairman of the Water Committee.—Austin. SYLVESTER WATTS, and others, propose to put in water-works.

Canada.—Kingston, Ont. The water-works have been transferred to the city, but the old management will be retained till the end of the year so that the city can get an insight into the running of the works.—Pembroke, Ont. A company of local capitalists is preparing to put in water-works at a cost of about $50,000.

Proposals Open.

Bridge.—W. B. WATSON, Chairman, Street Committee, Jacksonville, Fla.

Sidewalks.—ROBERT HOOKE, Superintendent, Board of Public Works, Chattanooga, Tenn. Oct. 24.

Macadam Paving.—Eleven blocks of Telford macadam pavement. F. J. H. BICKON, City Engineer. Also sidewalks. THE COMMISSIONERS OF PAVING DISTRICT No 2, Little Rock, Ark. Oct. 25.

Street Work and Sewer.—Trap block paving; 12-in. sewer pipe, manholes, etc. JOHN HUNKELE, Street Commissioner, Newark, N. J. Oct. 26.

Sewers.—Brick and pipe sewers; plans and specifications on file. ROBERT HOOKE, Superintendent, Board of Public Works, Chattanooga, Tenn. Oct. 27.

Granite Blocks.—Paving blocks, 8 to 10 by 3½ to 4½ by 7 to 9 ins.; 15,000 sq. yds.; also 10,000 tons of granite grout. HERBERT G. BRIGGS, Chairman of Street Committee, Portland, Me. Oct. 27.

Sewer.—Brick or stone, 6 ft. diam., 4,700 ft. long. Plans and specifications at the Mayor's office. WM. A. MORTON, Chairman of Street Committee, Lancaster, Pa. Oct. 28.

Pipe, Boilers, Trenching and Pipe Laying.—For water-works, 5,000 ft. of pipe. Plans and specifications on file. WM. A. MORTON (*as above*), Lancaster, Pa. Oct. 28.

Grading and Sewer.—Grading and 18-in. brick sewer. Plans and specifications at the office of City Engineer, A. C. M'KEE, Secretary, Highway Committee, Harrisburg, Pa. Oct. 28.

Sewers.—GEO. R. CONNER, Commissioner of City Works, Municipal Building, Brooklyn, N. Y. Oct. 28.

Street Work, Etc.—LOUIS WAGNER, Director of Public Works, Philadelphia, Pa. Oct. 28.

Lake.—At Roger Williams Park. Plans and specifications with the City Engineer. EDWIN LOWE, Chairman Park Committee, Providence, R. I. Oct. 29.

Street Improvement.—The County Commissioners, Cincinnati, O. Oct. 29.

Pipe Laying.—Laying 6-in. water pipe, setting valves, hydrants, etc. Plans and specifications at the office of the City Engineer. J. HERMAN KNISLEY, Secretary, Water Committee, Harrisburg, Pa. Oct. 29.

Sewers.—Plans and specifications on file. GEORGE E. POND, Asst. Q. M., U. S. A., Fort Riley, Kan. Oct. 31.

Sewers.—About 9,000 ft. of 9, 10 12 and 15-in. vitrified pipe sewer. Plans and specifications with the Village Clerk. H. P. SANFORD, Village Clerk, Painesville, O. October 31.

Steamer.—Stern-wheel steamer. VICE ADMIRAL S. C ROWAN, U. S. N., Chairman, Lighthouse Board, Washington, D. C. Nov. 1.

Crib Bulkhead.—Between E. 114th and E. 115th street, Harlem river. THE DOCKS COMMISSIONERS, Pier A, North river, New York City. Nov. 1.

Water Works.—F. R. ROSE, Fayetteville, N. C. Nov. 1.

Water Works.—Detailed plans and specifications to accompany each bid; amount not to exceed $8,000. T. D. GALLOWAY, Village Clerk, Wiarton, Ont., Canada. Nov. 1.

State Industrial Home.—At Chillicothe, Mo. J. D. FULTON, Architect. WM. MCILWRATH, Chairman, Board of Control, Chillicothe, Mo. Nov. 2.

Grading and Cobblestone Paving.—GEO. R. CONNER, Commissioner of City Works, Municipal Building, Brooklyn, N. Y. Nov. 2.

Setting Gas Lamp Posts.—GEO. R. CONNER, (*as above*), Brooklyn, N. Y. Nov. 3.

Railroad.—About 4,500 ft. of track. Plans and specifications prepared by JAMES WINANS, C. E., and on file. H. A. TOBEY, Secretary, Toledo Asylum, Toledo, O. Nov. 4.

Wooden Bridge.—To be built of Georgia heart pine; 155 ft. long, 5 spans, W. G. SMITH, Macon, Ga. Nov. 4.

City Hall.—Superstructure. Plans and specifications on file. ST. A. D. BALCOMBE, Chairman, Board of Public Works, Omaha, Neb. Nov. 4.

Sewer and Road Improvement.—The Hamilton COUNTY COMMISSIONERS, Cincinnati, O. Nov. 5.

Road Improvement.—Grading, macadamizing, culverts, bridges, etc. A. A. BRASHER, Engineer. E. GEO. JACOBS, Corporation Clerk, Mt. Airy, O. Nov. 5.

Iron Bridge.—Across the Brazos river; center span 240 ft., two side spans 160 ft.; tubular iron piers. WM. W. EVANS, Waco, Tex. Nov. 14.

Street Lighting.—Gas, electricity or other illuminant. C. A. CAMPBELL, City Clerk, Stockton, Cal. Nov. 14.

Court House.—For Lancaster county, Neb. Architects, E. E. MYERS & SON, Detroit, Mich. O. C. BELL, County Clerk, Lincoln, Neb. Nov. 15.

Contracting.

Pumping Engines.—The bids for the two pumping engines for Minneapolis, Minn., were returned unopened and the work is readvertised. Proposals will be opened Nov. 17. ANDREW RINKER, City Engineer.

Pile and Timber Foundation.—The following proposals for pile and timber foundation for Section V of the Boulevard avenue sewer, 3,500 ft., were opened Oct. 19 by A. B. HILL, City Engineer, New Haven, Conn.: Bruen & Shepard, New Haven, $6.13 per ft.; Lawrence O'Brien, New Haven, $6.35; C. R. Waterhouse, Jr., New Haven, $6.45; John & George H. Cavanagh, Boston, Mass., $7; A Brazos & Sons, Middlefield, Conn., $7.90; Wm. E. Ailing, $7.90. The following is the approximate estimate of quantities required to build 1 lin. ft. of pile foundation, no allowance being made for waste: ⅗ of a pile; caps., 6 ins. × 12 ins. by 11 ft., 14⅗ ft. B. M.; stringers, 4 ins. × 12 ins. × not less than 13 ft. 6 ins., 44 ft. B. M.; planking, 3 ins. × 11 ft. × not less than 8 ins., 33 ft. B. M.; 18-in. × ¾-in. dowels, 1⅗ lbs.; 9-in. × ¾-in. spikes, 1⅗ lbs.; 6-in. × ½-in. spikes, 1⅗ lbs.

Asphaltum Block Paving.—At Lancaster, Pa., Duke street is to be paved with the Norristown asphaltum blocks and the contract has been awarded to R. S. Oster & Bros., of Lancaster, at $2.69 per sq. yd. The blocks will be 12 ins. long, 4 ins. wide and 5½ ins. thick. The contractors will lay the foundation 12 ins. below the surface, relay the bed of stone 6 ins. thick, well rammed, with 2 ins. of fine gravel, making a foundation of 8 ins., all well rammed; this will be covered with a bed of sand upon which the paving blocks will be laid. The work will be guaranteed for 3 years.

The Flynt Building & Construction Company., of Palmer, Mass., has a contract for a depot for the Central R. R., at Elizabeth, N. J. Also for sewer work at Plainfield, N. J.

Pipe Wanted.—The Coleman Water-Works Co. Coleman, Tex., requires pipe and invites correspondence from manufacturers.

Doyle & Hudson, of Blountsville, Ala., are requiring about 1,800 ft. of 1¼-in. or 2-in. water pipe.

Dredging.—For dredging at Coaster's Harbor island, R. I., only one bid was received by Paymaster General JAMES FULTON, U. S. N. Navy Department, Washington, D. C. The bid was from C. M. Anthony, Fall River, Mass., but as it was informal and unaccompanied by guarantee it was not considered.

Fire Hose.—At Toronto, Canada, a contract for 2 000 ft. of hose has been awarded to T. McIlroy, Jr., for "Peerless" brand at 73 cts. per ft., guaranteed for 3½ years.

Water Supply.—The Board of Finance, Jersey City, N. J., has refused to approve the Board of Works resolution providing for a contract with the Bartlett Water Co. for a water supply for the city at a cost of $36.50 per 1,000,000 galls. The Board directed that advertisements be published inviting proposals for a water supply.

Brass Castings and Tubing.—The following proposals were opened Oct. 11 by the Water Committee, Montreal, Canada: Brass castings: I. E. F. Gaibord, 20 cts. per lb.; Cuthbert & Sons, 20 cts.; Garth & Co. 20 cts.; E. Chanteloup, 25 cts. The contract was awarded to I. E. F. Gaibord. Brass tubing, ⅜-in. diameter, welded joints, to stand a pressure of 15 atmospheres; Garth & Co., 23 cts, per lb.; E. Chanteloup, 24 cts. The contract was awarded to Garth & Co. All the bidders were local firms.

Machine Tools.—The Hall Steam Pump Co., 91 Liberty street, New York City, is about to increase its manufacturing facilities, and is in the market for the necessary machinery. The company is working night and day with its present capacity, and has a large number of home and foreign orders in hand.

Pumping Plant.—The Lawrence Machine Co., Lawrence, Mass., has the contract for 8 large centrifugal pumps for Montreal; to pump the sewage over the dikes now being built to protect the lower parts of the city from floods. Four of the pumps have a 24-in. discharge and a capacity of 18,000 galls. per minute, the others have a 15-in. discharge and a capacity of 7,000 galls. per minute. The total capacity of the plant will be 144,000,000 galls. per day.

Water-Works Contracts.—*Presque Isle, Me.*—Geo. W. Mantle, 22 Pemberton square, Boston, was the contractor for the water-works, and also for the village sewer. The water-works are now in operation. G. H. FREEMAN is Superintendent.

Lancaster, Pa.—The following proposals were opened Oct. 7 by the Special Committee of Council, for the buildings and conduit for the new works: McLaughlin & Gessell, $49,150; B. A. Malone and Thos. C. Wiley, $32,887; John A. Burger, $29,444; John Evans & Son, $24,900; Amos S. Urban, $18,750 (or $17,750 if the committee would agree to substitute a limestone wall, laid in cement mortar, instead of concrete); George Ernst, Jr., $17,050 (without conduit). The contract was awarded to Amos S. Urban, at $18,750. Later, however, Mr. Urban reported that he had made a mistake in his figures and could not undertake the contract. Instead of awarding it to the next lowest bidder the work was re-advertised, and the following proposals were opened Oct. 13: B. A. Malone and Thos. C. Wiley, $29,750; John A. Burger, $28,387 (or $27,247 for brick instead of granite bases for engine and boiler house and stack); John Evans & Son, $24,900; Amos S. Urban, $24,480; the following three bids were informal: McLaughlin & Gessell, $35,000; George Ernst, Jr., $24,550.28; I. P. Mayer, $23,800. The contract was awarded to Amos S. Urban at $24,480. Work has been commenced and is to be completed by February. The contract does not include the removal of the engines, nor the trenching and pipe laying. A sub contract for excavation has been let to Hy. Shaub. The water-works will be built under the charge of Chief Engineer S. SLAYMAKER.

Petersburg, Ill.—The contract for the water-works has been awarded to D. Fisher, a local contractor, for about $20,000. The works are to be completed by January.

Omaha, Neb.—The water company has awarded the contract for the settling basins at Florence to Callahan Bros., of Omaha, at about $25,000. It has also awarded a $400,000 contract for pipe to the Cincinnati & Newport Iron & Pipe Co., of Newport, Ky.

Long Pine, Neb.—The contract for the works was let to S. K. Felton, of Omaha, for $7,000; Albert Miller, of Long Pine, has the contract for the tank and derrick. A. A. RICHARDSON, of Lincoln, is Chief Engineer.

Pawnee City, Neb.—The contract for the works, exclusive of the wells, has been awarded to Chas. Schroeder, of Columbus, Neb., for $25,125; the wells were awarded to H. F. Cook, of Omaha, at $2,500. A. A. RICHARDSON of Lincoln, is Chief Engineer.

Washington, D. C., Estimates for 1887-88.—These estimates are apportioned generally as follows for the engineer department:—Field-work, $16,300; work on street pavements, $805,519; repairs to concrete pavements, $100,000; constructing, maintaining and lighting bridges, $27,000; condemnation of streets, roads and alleys, $10,000; filling streets and alleys, $10,000; continuation of surveys, $10,000. Sewer division; cleaning and repairing basins and sewers, $35,000; replacing obstructed sewers, $15,000; preparation of plans for sewage disposal, $5,000; main and pipe sewers, $75,000. Telegraph and telephone division; putting district wires underground, $25,000; district surveyor's division, $1,700; harbor division, $9,900; engineering, maintenance, and general repair of Washington aqueduct, $20,000. The building division, $11,200. Plumbing division; $4,450. For the lighting division, $140,000 is estimated, of which sum $100,000 is asked for illuminating material, lighting, extinguishing, and repairing lamps; $30,000 for electric lights, and the balance for additional office help. For the division of roads, $5,830 is asked. For the parking and tree division the commissioners ask $23,000. For the property division, $8,920. Total for construction and maintenance of country roads and suburban streets; eastern section, $17,500; middle section, $68,400; western section, $12,000; total, $97,900.

For the expenses of the water office the sum of $23,100 is asked. This is to provide for additional clerks, inspectors, draughtsmen, etc. For engineers, firemen, fuel, material for high service in Washington and Georgetown, pipe distribution to high and low service, including public hydrants, fire-plugs, material, and labor, repairing new mains, etc., and lowering mains, etc., $100,000; purchase of pump-house lot on N street northwest, $2,275; laying water main to Anacostia, $2 500; laying water main to Mt. Pleasant, $7,500; interest on water stock bonds, $26,250; sinking fund on water stock bonds $18,300; interest on account of increase of water supply under act of July 15, 1882, $34,575.39; sinking fund on account of increase of water supply under the same act, $52,386.96. Street and alley division; for the office the sum of $7,430 is asked, for clerks, rodmen, etc.; sprinkling, sweeping, and cleaning streets, avenues and alleys, $85,000; maintenance of streets, avenues and alleys, $50,000; material for permit work, $100,000. This disposes of the $1,028,474.03 for the engineer department.

Water Stock.—The Commissioners of the Sinking Fund, New York City, opened the proposals for $3,000,000 Croton water stock on Oct. 18. The following awards were made: Bowery Savings Bank, $65,000 at par, $200,000 at 100.50, and $200,000 at 101; Daniel A. Morgan, $110,000 at 101.157; Charles M. Whitney & Co., $100,000 at 100.75; Moller & Co., $1,000,000 at 100.125; Booth & Campbell, $500,000 at 100.10; German Savings Bank, $100,000 at par, and $500,000 at 100.25; Atlantic Trust Company, $200,000 at 100.055, and Safe Deposit Company of New York, $25,000 at 101.56.

Sewers.—*Brooklyn, N. Y.*—City Engineer VAN BUREN has reported to the Commissioner of City Works that it will cost $149,000 to build sewers for the relief of the flooded districts.

Syracuse, N. Y.—The contract for the James street sewer has been awarded to Martin & Sprague, and that for the Gifford street sewer to Hugh Purnell.

Buffalo, N. Y.—The contract for a 36-in. and a 30-in. brick sewer in Sycamore street has been awarded to P. B. McNaughton at $5,638.

La Grange, Ill.—The contract for the Madison avenue sewer has been awarded to John Lyons for about $3,000.

Milwaukee, Wis.—The contract for the last section of the sewer in the Menominee sewerage district has been awarded by the Board of Public Works to C.H. Sullivan, at $12.31 per lin. ft. for ordinary work, and $15.28 per lin. ft. where extra foundations are necessary.

Burlington, Ia.—The following proposals have been received for constructing the Angular street sewer: John Loftus, $12.35 per lin. ft.; E. Kropp & Co., $10.45; F. Hoppmann, $10.15.

Montreal, Canada.—Sewer contracts have been awarded as follows: Thos. Heffernan, $6.37 per ft.; Jas. Cochrane, $7. 40, $6.39, $6.34; C. Bellemarc, $7.65, $7.05, $6.15; L. McDonald, $7.75.

Paving.—*Brooklyn, N. Y.*—The following proposals for blue stone curbing and Belgian block paving have been received by the Commissioner of City Works: On Crescent street; Thos. McCann, 90 per lin. ft; John H. O'Rourke, $10.67; Daniel Gallagher & Son, $11; Charles Hart, $11.31; Thos. Monahan, $12.35; Charles Guidet, $14.03.— On Glenmore avenue; Thos. McCann, $9.84; John H. O'Rourke, $10.49; Thos. Monahan, $11.40; Chas Hart, $11.45; Charles Guidet, $15.22.

Buffalo, N. Y.—The following contracts have been awarded by ALBERT KRAUSE, City Engineer: Paving Carolina street with second quality Medina sandstone, C. E. Williams, $7,164; paving Elmwood, avenue with A. L. Barber's Trinidad asphalt pavement, and with Medina stone and 12 ins. of sand between the car tracks, A. L. Barber, Washington, $705.54; repaving Swan street in similar manner to Elmwood avenue, A. L. Barber, $14,828.05; paving Jersey street with second quality Medina sandstone, A. M. Holloway, $7,888.

Chicago, Ill.—The lowest bids for cedar block paving on several streets, received recently by the Commissioner of Public Works, were $1.06, $1.07, $1.08, $1.09, $1.10, $1.12, $1.15 and $1.20 per sq. yd. The lowest bids for stone paving were; $3.56 per sq. yd. for "Berlin;" $3.58 for any stone in accepted list; $3.63¼ for Argyle granite; $3.63½ for Aberdeen granite and $3.63¾ for Green Lake or Montello granite. The bids for curbing on various streets ranged from 70 cts. to 78 cts. per lin. ft.

East St. Louis, Ill.—The following proposals have been received for improving Front street: Allen & Veith, grading, 55 cts. per cu. yd.; granite paving, $46 per sq. of 100 ft.; limestone curb, 80 cts. per lin. ft.; granite curb, $2 per lin. ft.; Eyermann & Schmaltz, 50 cts., $49.50, $1, $1.60; Neimes & Reimann, $1.25, $47.50, 80 cts., $1.40. The contract was awarded to Allen & Veith, of St. Louis, Mo., at $104,279; the street will be 6,283 ft. long and 30 ft. wide.

St. Paul Minn.—The following contracts have been awarded by the Board of Public Works: grading Mackubin street, Geo. Gerlich, $2,150; grading Brainard avenue, C. F. Huebner, $3,850; grading Robert and other streets, Thos. T. Steers, $61,200; paving Prince street, Wm. Forristal, $3,470.

Toronto, Canada.—The following contracts have been awarded by the Committee on Works: Sewers; Patterson & Booth, $1,040 and $445; Burns & McCormack $11,115, $365, $6,330 and $723; Wm. Jones, $2,422 and $1,429; A. W. Godson, $1,189; A. J. Brown, $682; Wm. Cathro, $1,300.——Cedar block pavements; D. L. Van Vlack, pavement, 75 and 83 cts. per sq. yd.; curbing, 18 cts. per lin. ft.; crossing plates, $2.50 per 100 pounds. Wm. Cathro, 98 cts., 22½ cts., $3. Burns & McCormack, 80 cts., 19 cts., $2.75. Ardagh & Leonard, 75 cts., 18 cts, $2.50.——Cobble paving; A. W. Godson, 90 cts. per sq. yd.——Grading; Wm. Cathro, excavation, 13¾ cts. per cu. yd.; cutting down and grubbing out trees, $1.50 each; post and board fence, 12 cts. per lin. ft.; culverts, $10 and $6. F. B. Morrow, $1,347 (lump sum).

It is stated that in future no cedar blocks will be allowed to be laid down on the natural bed, as the fine loam is very injurious and causes a dry rot to set into the wood.

Bridges, Canals, Etc.

Trent Valley Canal.—A commission has been appointed to report on the completion of the canal. Mr. JOHN KENNEDY, Chief Engineer for the Montreal Harbor Commissioners, and Mr. FRANK TURNER, C. E., of Toronto, are members of the commission.

Sault Ste. Marie Canal.—Canadian government surveyors are at work surveying routes for the canal on the Canadian side of the river. The canal will be about a mile long, and will have two locks, the total fall between the upper waters of Lake Superior and the lower reaches of the St. Mary, being 18 ft.

Muscel Shoals Canal.—The work on this canal on the Tennessee river is about completed, and in a few weeks boats will be able to pass through. Mr. JOHN PORTEOUS, Jr., is Superintendent of the work. Before the war the State of Alabama made an unsuccessful attempt to cut a canal around the shoals, and the present work has been in progress for about 15 years.

The Columbia River Bridge Co. has been incorporated at Portland, Ore., to build a highway and railroad bridge across the Columbia river from the Oregon shore, at a point between Fairview and Frontdale, taking advantage of Lady island and some reefs, which make this a favorable point, to the town of La Camas, to connect with the La Camas & Puget Sound R. R. The incorporators are H. S. ROWE, M. C. GEORGE, R. L. DURHAM, D. H. STEARNS and H. L. PITTOCK. The company has a capital stock of $500,000, and has an office at Portland, Ore.

The Randolph Bridge.—The Chicago, Milwaukee & St. Paul R. R. ran its first train over the Missouri river bridge at Randolph Point, near Kansas City, Oct. 11. The train carried the engineers and a large party of railroad officials, and ran to within a short distance of the Clay county shore, being unable to proceed further in consequence of a portion of the trestle approach not being completed. The preliminary work of sinking the caissons was commenced November 2, 1886; work was carried on during the winter, and in spite of many difficulties from high water the piers were completed on July 11. The bridge has three spans of 400 ft. and its total length, including the south approach, is 7,344 ft. Part of the trestle is iron and part wood. The first regular train is expected to cross the bridge Nov. 1.

New Bridges.—*Massachusetts.*—The Fitchburg R. R. Co. is building a new iron bridge across the Green river at Greenfield. It is being erected on the piers of the old bridge.

Connecticut.—The New England R. R. Co. is building a new double-track iron bridge across the Hockanum river near Manchester. The masonry is completed and the trusses are being put up. The bridge is close to the south side of the existing wooden structure.

New York.—The new bridge of the Rome, Watertown & Ogdensburg R. R. over the Genesee river at Rochester was formally opened Oct. 3 and tested Oct. 17.

Maryland.—An iron bridge at Ruxton station, near Towson, will be built by Baltimore county and the Northern Central R. R. Co. at a cost of about $8,000.

Pennsylvania.—At Pittsburg, the Pennsylvania R. R. Co. will build a large iron bridge over its tracks at 33rd street.——The Pennsylvania Co. has been authorized to build a bridge across the Ohio river at Brunot's island, near Pittsburg. The bridge will be completed in about a year.

Ohio.—The big Ohio river bridge for the Chesapeake & Ohio R. R. at Cincinnati, is progressing. The caisson for the pier on the Cincinnati side is nearly completed and the pier is several feet above water; the caisson and pier on the Covington side are also well forward. All the masonry is expected to be completed this year.

Virginia.—The Shenandoah Valley R. R. Co. proposes to replace 16 small wooden bridges with iron structures. Address D. W. FLICKWIR, Superintendent, Roanoke, Va.

West Virginia.—It is proposed to build a railroad bridge across the Ohio river at Wheeling, and public feeling is in favor of the project.

Tennessee.—The substructure of the Hyde's Ferry bridge, at Nashville, is progressing, and work on the superstructure will be commenced in December.

Georgia.—The Oconee Bridge Co. (Dr. R. H. HIGHTOWER and T. M. HIGHTOWER) proposes to bridge the Oconee river at Dublin; another project is to build the bridge out of public funds. Address T. H. BUSH, Mayor, Dublin, Ga.

Colorado.—A double-track bridge over Cherry creek, near Denver, on the site of the old bridge of the Denver, Texas & Fort Worth R. R., is now being built jointly by the Colorado Midland, Denver & Santa Fé and Denver, Texas & Fort Worth railroads.

Nebraska.—The Rulo bridge of the Burlington & Missouri River R. R. has been opened for freight traffic, but will not be used yet for passenger trains.——At Omaha work has been commenced on the new Broadway bridge.

Arkansas.—The county court has appropriated $3,000 and $1,000 respectively, for bridges across Cache river and a swamp near White river.

Texas.—Tom Green county will build an iron highway bridge with a span of 150 ft. and a roadway 18 ft. wide; the approaches will be 240 and 180 ft. long. Address WM. S. KELLY, San Angelo, Tex.

Canada.—The railroad bridge across the river at Fredericton, N. B., is being pushed rapidly; it will be a steel bridge with 9 spans. It is expected to have all the piers above the water by Nov. 15. The Dominion Bridge Co. has the contract for the superstructure.

Mr. S. S. Green, of Point Levis, P. Q., has gone to Ottawa to submit to the government a plan for a bridge from the Louise basin, Quebec, to the island of Orleans, and thence to the lower part of Levis parish.

It is reported that the Dominion Government has authorized the construction of a bridge over the St. Charles river, P. Q., for the joint use of the Lake St. John Ry. and the projected line to La Bonne Ste. Anne

RAILROADS.

East of Chicago.

Existing Roads.—*Toledo, Saginaw & Mackinaw.*—The contract for building this Michigan road has been awarded. The work is to be completed July 1, 1888.

New York City & Northern.—This company has been reorganized, with JOEL B. ERHARDT as President. A double track branch is to be constructed in the city of Yonkers.

Toledo, Saginaw & Muskegon.—On this Michigan line, a portion of the Toledo, Ann Arbor & North Michigan system, track has been laid from Ashley to Sheridan, 30 miles; and is progressing at the rate of 1½ miles per day. Work was also begun on the 17th inst. on the tracklaying from Muskegon east, and the entire line, 95.9 miles in length, is expected to be finished by Nov. 20. H. C. SMITH is Chief Engineer.

Seaconnet.—We are informed that this Rhode Island line, which was noted in our recent list as under contract, has not yet been put under construction and does not seem likely to be.

Baltimore & Drum Point.—Ground has been broken on this Maryland road. ROGERS & CLEMENTS, of Baltimore, are the contractors.

New Projects and Surveys.—*Erie & Central New York.*—The proposed line of this road extends from Deposit, on the Erie Railroad, *via* Nineveh, Smithsville and Cortland to Syracuse. Capital and right of way are partially secured and 16 miles are graded. LEWIS S. HAYES, of Cortland, is President.

Lancaster & Hamden.—It is reported that the contract for this Ohio road has been let to JAS. H. KYNER. JAS. BALLARD, of Tarlton, is interested and can probably give information.

Newburgh & Poughkeepsie.—Surveys are to begin soon on this New York road. SIMON W. ROSENDALE, of Albany, is interested.

Southern.

Existing Roads.—*Western & Atlantic.*—This road is owned by the State of Georgia, and is leased to a syndicate headed by Senator JOSEPH BROWN. A short time ago the lessees announced that at the expiration of the lease the betterments would not be surrendered to the State. The matter was taken up by the legislature and a resolution was passed demanding that the lessees increase their bond to $2,000,000, and that if this were not done within thirty days, the Governor be instructed to take possession of the road. The matter is now under further consideration by the legislature, and there is a prospect that there will be a sharp fight over the matter.

Sheffield & Birmingham.—This Alabama road is completed from Sheffield south 52 miles, and the remainder is nearly all under contract.

Nashville, Chatanooga & St Louis.—The branch to Dunlop, Tenn., has been completed.

Atlantic & Danville.—About 1,000 men are now at work on this Virginia road.——The directors have elected THOS. EWING, President, to fill the vacancy caused by the death of B. T. TILLAR.

Mobile & Birmingham.—About 50 miles of the eighty between Marion Junction and the crossing of the Tombigbee river have been completed. Trains will be run over the completed section at once, crossing the river by a transfer boat until the bridge is finished.

Louisville & Nashville.—In response to inquiries, we would explain that the statement for this road in our issue of Oct. 8 referred only to that portion of Kentucky shown on the map. The work of the company now in progress will be shown on the next map of the series.

Georgia, Carolina & Northern.—Tracklaying is to begin at once on the Carolina division, and about 50 miles will be laid this fall.

New Projects and Surveys.—*Gulf & Chicago.*—The preliminary survey of this line from a point on the Memphis & Charleston Railroad to Mobile, Ala., is nearly completed.

Atlantic, Birmingham & Western.—It is stated that E. C. MACHEN, of New York, has taken the contract for building this line.

Chatanooga, Cleveland & Murphy.—It is stated that the surveys are being pushed on this line and that the several companies that have been formed will be consolidated and will work together for the completion of the road. EDWARD WATKINS, of Chattanooga is interested.

The Northwest.

Existing Roads.—*Milwaukee, Lake Shore & Western.*—The company has filed a notice with the Wisconsin Secretary of State that the Rhinelander branch will be extended northwest to Hurley, a distance of 75 miles.

Jacksonville Southeastern.—Tracklaying is in progress on the 20 mile extension from Centralia, Ill., south.

Chicago & Northwestern.—It is reported that a line has been surveyed from Tracy to Dempster, Dak.——The tracklaying is completed on the extension of the Fremont, Elkhorn & Missouri Valley system to Hastings, Neb., from Linwood, a distance of 103 miles.

St. Paul, Minneapolis & Manitoba.—A Duluth rumor credits this company with the intention of building a new double track road from St. Paul to Duluth, but Duluth rumors are not invariably founded on fact. The system will doubtless be extended to Duluth at an early date from Brainerd and Hinckley, and after this is done there will be time to consider the proposed eastern line.——The line from Moorhead to Wahpeton, Dak., is being ballasted and will soon be open for traffic.——The completion of the extension to Great Falls caused great rejoicing at that place. The tracklaying force are now working toward Helena.

Minnesota & Northwestern.—Associates of President STICKNEY have just incorporated the Chicago Stock Yards Company with a capital stock of $10,500,000, and the Chicago Transfer Railway Company with a capital of $2,000,000.

New Projects and Surveys.—*Winona & Southwestern.*—The first preliminary survey has been completed from Winona, Minn., to Mason City, Ia.

Springfield & Southern.—The right of way has been nearly all secured for this Illinois road, and steps toward active construction are soon to be taken.

The Southwest.

Existing Roads.—*Atchison, Topeka & Santa Fé.*—Right of way is being secured for the line from Chanute to Fort Scott, Kan., where it will meet the St. Louis, Kansas City & Colorado division.——A spur is to be built from the main line of the Chicago, Santa Fé & California road to Independence, Mo., a distance of about 4 miles.——The total of track laid on all extensions of the system during the month of September was 123 miles.

Union Pacific.—The Oakley & Colby line, 25 miles in length, in western Kansas, is now completed and open for business.

Cape Girardeau & Southwestern.—The survey for the extension to connect with the Current River branch of the Kansas City, Fort Scott & Gulf has been completed.

Batesville & Brinkley.—An extension of 25 miles is said to be contemplated.

New Projects and Surveys.—*Kansas City, Watkins & Gulf.*—An election to vote aid to this Louisiana project will be held at an early date.

Denison & Washita Valley.—The locating surveys are completed to the Red river and the contracts for the bridge over that stream and the construction of the road are to be let at once.

Brownsville & Corpus Christi.—A movement is on foot at Brownsville, Tex., to build a line up the coast to Corpus Christi about 75 miles, and $100,000 has been raised to further the project.

New Orleans, Natchez & Ft. Scott.—President J. H. RICE claims to have secured subsidies for his road in Arkansas and Louisiana to the amount of $2,000,000.

Kansas City, Lawrence & Nebraska.—Preliminary surveys are completed from Lawrence through Meriden, Hoyt, Westmoreland, Randolph, Greenleaf, Washington, Haddam nearly to State line and from Spring Ranch through Hastings to Grand Island, Nebraska. One party is filling in gap near State line, and another surveying from Lawrence to Kansas City.

Paragould & Buffalo Island.—This company has been incorporated in Arkansas by JOSEPH BOYKINS and others.

Rocky Mountain and Pacific.

Existing Roads.—*Southern Pacific.*—The newly completed portion of the California & Oregon road has been opened for business, and trains are now running to Siskiyou, Cal. This reduces the stage connection to the 13 miles from Siskiyou to Ashland, Ore.——The company is also said to contemplate several short extensions in the vicinity of San Bernardino, Cal.——The San Pablo & Tulare road, which was graded to Hill's Ferry some months ago, is being surveyed on south, while tracklaying is to begin at once on the completed grade.

Northern Pacific.—Among the projects for next season's work is a branch to White Sulphur Springs, Mont.

Denver & Rio Grande.—A large force is at work laying a third rail on the line between Pueblo, Col., and Glenwood Springs, for the use of the Missouri Pacific, which will reach Pueblo before the end of the year.

New Projects and Surveys.—*San Francisco & San Joaquin Valley.*—It is reported that a large force of graders are to begin work at once on this California road at Dutch Corners, 43 miles south of Tracy.

Port Townsend Southern.—This is a projected road in Washington Territory, 175 miles in length, from Puget Sound to Kalama on the Columbia river. A. W. MOORE, of San Francisco, is interested.

San Diego & Julian.—R. W. WATERMAN, of San Bernardino, is interested in this proposed road in southern California, about 30 miles in length.

Mexican International.—The extension from Castawo to Villa Lerdo will be completed next month.

Missouri Pacific.—The latest reports which have enlivened the bustling town of Los Angeles, state that the syndicate which recently purchased Rattlesnake Island is in the Gould interest, and that the Missouri Pacific proposes to undertake the Salt Lake City & Los Angeles project.

Electric Railway.—The St. Catharines Street Railway Co., of St. Catharines, Ont., has opened a line, 6 miles long, from that city to Thorold. The line is operated by electricity on the Van Depoele system; there is a dynamo of 1,100 H. P., which is driven by water power from the Welland canal. The cars are equipped with a 15 H. P. motor placed on the front platform. The time between the two cities is 20 minutes.

The Arcade Railway.—The Directors of the Arcade Railway, New York City, at a meeting on Oct. 18, elected the following officers: President, CHARLES P. DALY; Vice President, WM. WINDOM; Second Vice President and General Manager, MELVILLE C. SMITH; Treasurer, GEORGE S. COE; Secretary, EUGENE W. AUSTIN. It is reported that several propositions have been made by contractors to build the road and the officers of the company say that arrangements will soon be made and a contract closed. At present it is not yet settled at which end of the route work will be begun, but the majority of the board are supposed to favor beginning at the Battery. A proposition has been made, however, to first build a mile of the road down-town from 59th street.